Consulting Engineer



March, 1958



B. M. DORNBLATT, president of B. M. Dornblatt & Associates, New Orleans, is one of the founders of the Consulting Engineers Council and, several years earlier, of the Gulf Institute of Consulting Engineers. As early as 1948, two years after he formed his own business, Dornblatt realized the

Continued on page 8

POWELL

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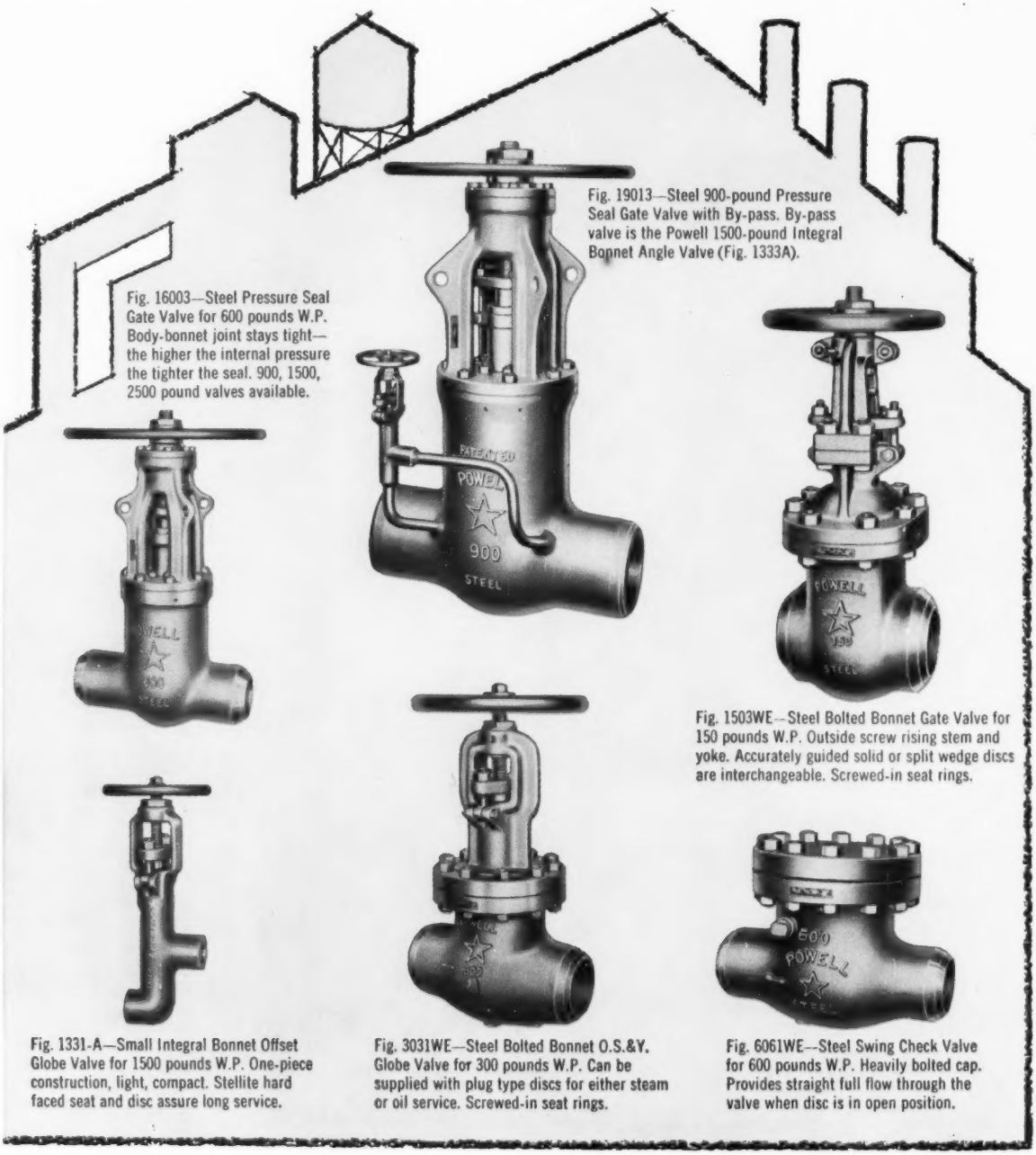


Fig. 19013—Steel 900-pound Pressure Seal Gate Valve with By-pass. By-pass valve is the Powell 1500-pound Integral Bonnet Angle Valve (Fig. 1333A).

Fig. 16003—Steel Pressure Seal Gate Valve for 600 pounds W.P. Body-bonnet joint stays tight—the higher the internal pressure the tighter the seal. 900, 1500, 2500 pound valves available.

Fig. 1503WE—Steel Bolted Bonnet Gate Valve for 150 pounds W.P. Outside screw rising stem and yoke. Accurately guided solid or split wedge discs are interchangeable. Screwed-in seat rings.

Fig. 1331-A—Small Integral Bonnet Offset Globe Valve for 1500 pounds W.P. One-piece construction, light, compact. Stellite hard faced seat and disc assure long service.

Fig. 3031WE—Steel Bolted Bonnet O.S.&Y. Globe Valve for 300 pounds W.P. Can be supplied with plug type discs for either steam or oil service. Screwed-in seat rings.

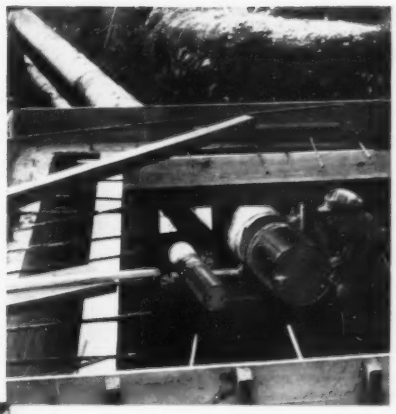
Fig. 6061WE—Steel Swing Check Valve for 600 pounds W.P. Heavily bolted cap. Provides straight full flow through the valve when disc is in open position.

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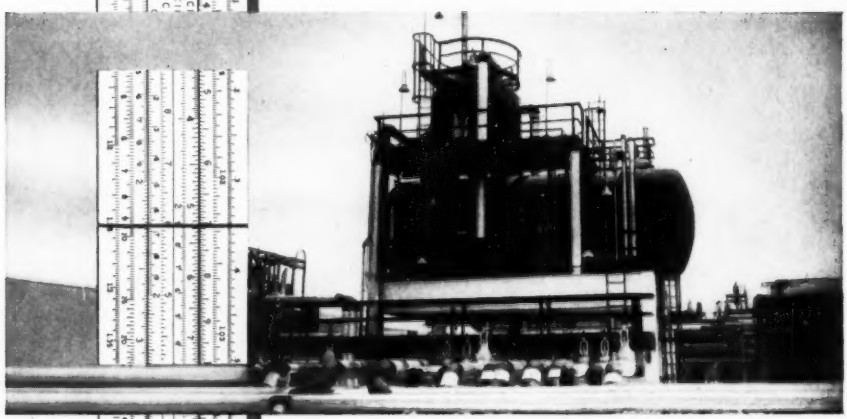
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Consulting Engineer

The Consulting Engineer's Professional Magazine

Wayne near Pleasant Street
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March. 1958 • VOLUME X • NUMBER III

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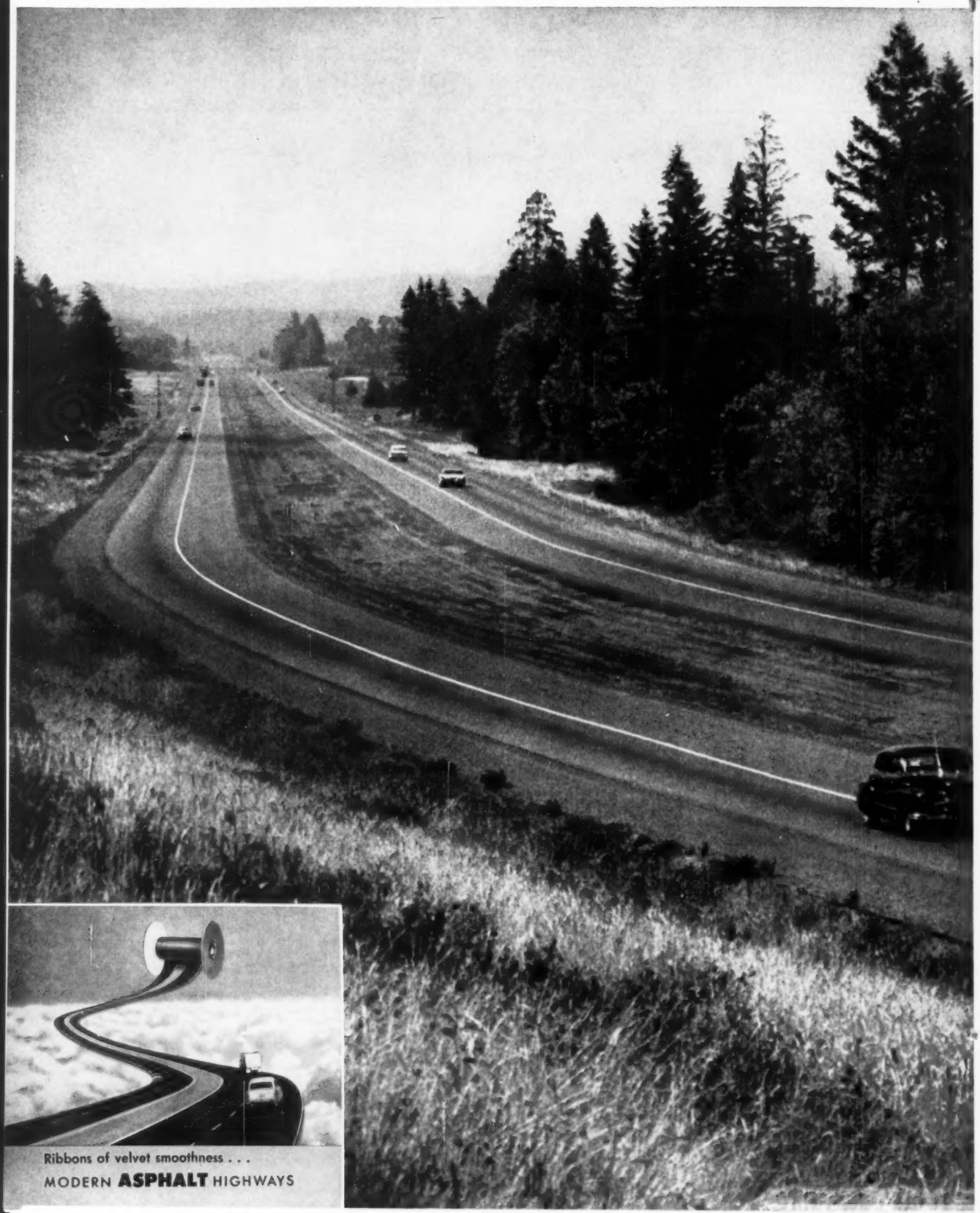
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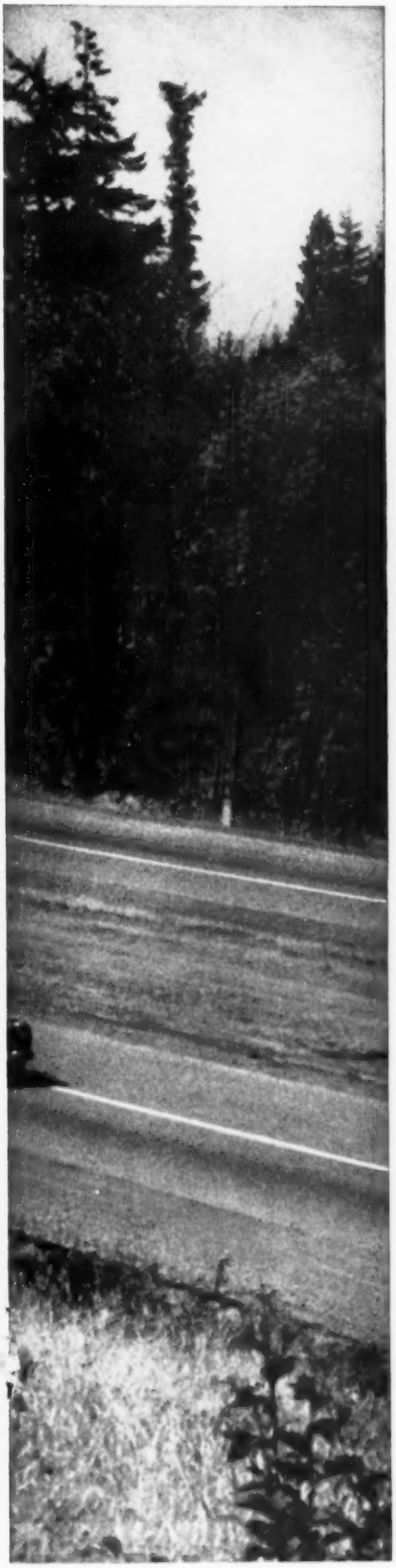
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MODERN **ASPHALT** HIGHWAYS

Washington $30,000 a mile



...Saves State $381,000 in first cost on 12.7 miles of Interstate Highway. Maintenance savings expected, too!

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B. M. Dornblatt

—*Starts on front cover*

need for a management organization in which consulting engineers could discuss mutual problems.

After several years of planning and organization, Dornblatt and others formed the Gulf Institute of Consulting Engineers, one of the first organizations of engineers in private practice in the nation. Later, Dornblatt was a member of the Interim Committee that drafted the constitution for the Consulting Engineers Council. When the Council was formed in 1955, Dornblatt was elected a vice president. At present, he is Council treasurer.

Lt. Colonel in Corps of Engineers

The son of an Athens, Ga., contractor, Dornblatt has spent most of his professional life in the Deep South. He was first graduated from the University of Georgia and then received his master's degree in civil engineering from Georgia Institute of Technology, in 1934. After working in South Carolina and Georgia, Dornblatt went to New Orleans in 1936 as structural engineer, and later, senior field engineer, for the Portland Cement Association.

In the Corps of Engineers during World War II, Dornblatt rose to Lieutenant Colonel. Stationed in Luzon, he helped plan engineering aspects of the invasion of Japan. Then, landing with the initial occupation forces, he was placed in charge of all military and civilian engineering projects for the American and Allied forces in the Tokyo-Yokohama area. He was awarded the Legion of Merit for this military engineering work.

When he arrived in Yokohama, the area was nearly deserted and had been almost leveled by napalm bombs, so his first project was the rebuilding of public utilities and roads for the desolate city. Later he supervised the design for one of the world's first hydroponic farms. Located just outside of Tokyo, the experimental farm proved a huge success in providing vegetables for the occupational forces. At last report the farm still was under Air Force control.

Another large project handled by Colonel Dornblatt in Japan was the design of the largest air base in that nation. American dredging equipment had to be imported for the base, which was built out into Tokyo Bay.

The language barrier created one of the principal difficulties in Dornblatt's Japanese projects. However, his native workers learned a smattering of English, and Dornblatt learned to speak a little Japanese with only a slight Southern accent.

Initial Projects Mainly Structural

While in service, Dornblatt met two engineers, S. O. Coxe, Jr. and B. A. Grehan, with whom he formed an engineering corporation. Located in the heart of New Orleans' financial district, Dornblatt's offices occupy a three-story building. The firm, with 30 employees, currently is handling projects valued at an estimated $25 million. It offers complete civil, structural, mechanical, and electrical engineering services. "And we handle any projects we can travel to in one night."

When the firm was young, most of its projects were structural work with architects. The firm's first major project was the structural design of New Orleans' 14-story Texaco Office Building. The structure, built to withstand hurricane wind velocities, was the first all-welded, multi-story building in the city. Built on the pile foundation necessary in New Orleans, it has most of the bracing in the floors and walls.

Specialists in Highways and Bridges

Dornblatt, whose personal specialty is highways and bridges, also was a consultant on the New Orleans Union Passenger terminal program. On this project, five railroad stations were consolidated and about 130 grade crossings eliminated.

At present, the Dornblatt firm also is designing 12 miles of Federal highway through Southwest Louisiana rice paddies. This four-lane highway presents some unusual problems. On a 300-ft fenced in right-of-way, the $10 to $12 million highway crosses four canals, is crisscrossed with irrigation channels, and has four grade separations. To date, the government has not decided what arrangement to allow for the patrols, who regulate the irrigation gates, to cross over or under the new highway.

Another Dornblatt project is the Shell Oil Co. installation at the mouth of the Mississippi River. The petroleum company asked Dornblatt to design facilities for loading oil barges at the termination of pipelines from the offshore facilities.

They designed nine cylindrical islands, each 21 feet in diameter, parallel with the shore and located 50 feet out into the channel. The project is valued at an estimated $1,500,000. The islands, built on a soft mud base, are connected by a suspension bridge.

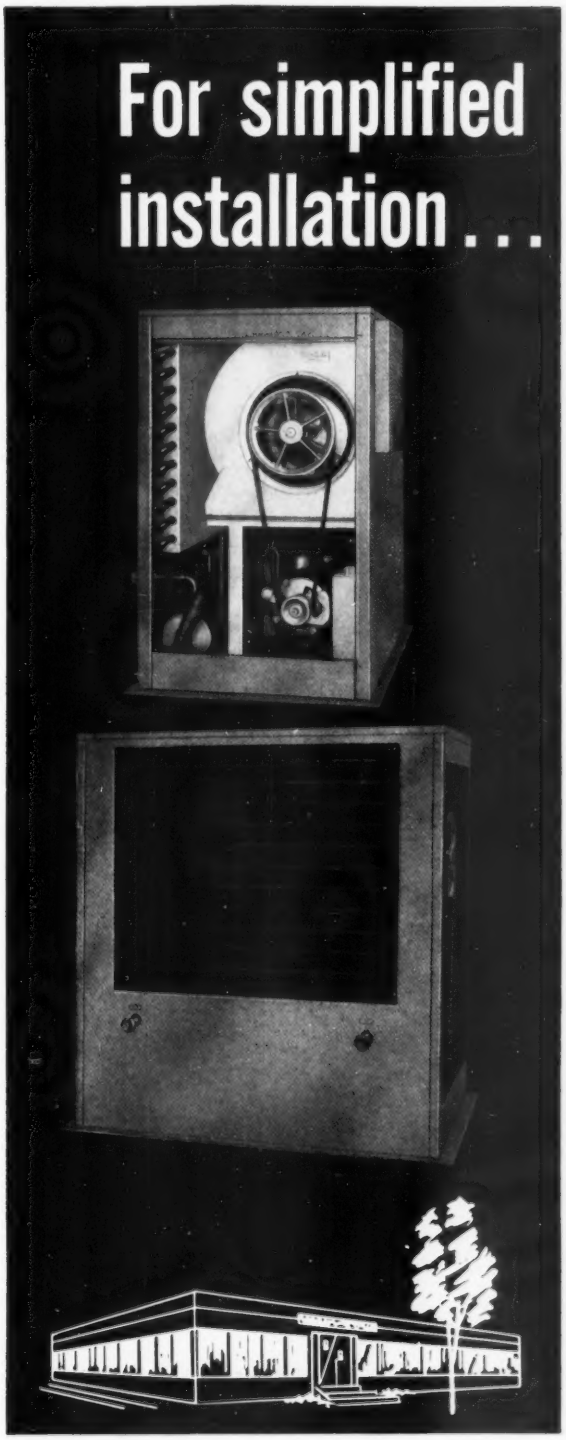
At present, Dornblatt is doing the structural design for the $20-million Post office and Federal building, which will cover several blocks near the new Civic Center, in New Orleans. The Federal office building, to be of steel frame, will be designed to withstand 70-psi wind loads. The New Orleans city code requires only 40 psi.

Engineers Do Own Drafting

Dornblatt's diversified staff of 30 includes 20 engineers and only three draftsmen. Each engineer on Dornblatt's staff is required to do his own drafting and design work. New men are taught the office drafting system by the older employees. "Although this is a costly way to handle drafting, the results warrant the costs," Dornblatt commented.

In order to give the staff diversified experience, Dornblatt assigns each man to as many different types

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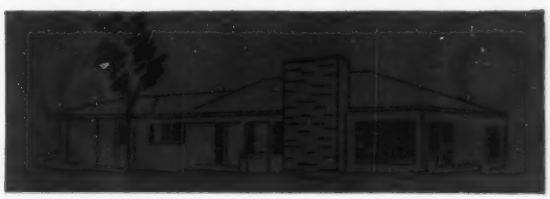


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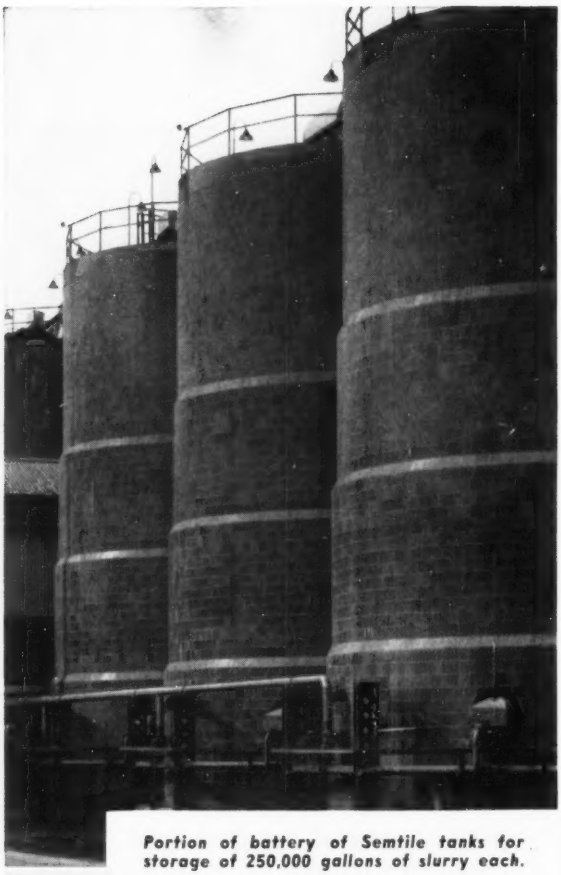
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of projects as possible. "The result is better than average engineers."

Young Engineers Pose Problems

Dornblatt is a firm believer in engineering registration. "Normally, I want every man in my firm to be registered or secure his registration within a year. Dornblatt, himself, is registered in Louisiana, Georgia, Mississippi, Alabama, and Pennsylvania.

At present, Dornblatt is very much concerned over the professional outlook of the young college graduates who apply for positions with his New Orleans consulting firm.

In Louisiana and the neighboring states, the employment situation presents a number of problems. The proximity of the oil and shipping interests results in a highly inflated salary picture. In New Orleans, Dornblatt says, it is necessary to pay 15 percent higher wages than in nearby Texas.

"The supply and demand picture is changing though, particularly within the past few months. We have had more and more young engineers returning from California and elsewhere looking for jobs."

However, Dornblatt does not think that an end to the engineering shortage necessarily will solve the employment problems of southern consultants.

"It's a problem of attitude, more than one of finances. These boys coming back to New Orleans still have an inflated idea of their own ability and of the salaries they should receive.

"In Louisiana, there is no Engineer-in-Training program. A youth can become a registered engineer upon graduation. Many who are not offered starting wages commensurate with their own ideas go to small communities and open their own offices. Knowing nothing of the economic problems involved in operating an office and lacking the experience to set adequate fees, the beginning engineers undercut recommended minimum fees. This, plus their lack of professional experience, is prevalent enough to give the entire profession trouble.

"Something is missing in the education of these boys. I do not know just how the situation could be corrected, but it is something all engineers should be worried about," Dornblatt concluded.

Hosts CEC Executive Committee

Active in a number of engineering organizations, Dornblatt last month acted as host to the Consulting Engineers Council Executive Committee meeting. For this meeting he prepared the Council's new articles of incorporation.

Incorporation of the Council is necessary before the group can get a tax-free classification. They are incorporating in Louisiana because the corporate laws are only five years old, making them among the most modern in the nation.

The Council bylaws also are being revised. This was necessary in order for future Council officers to

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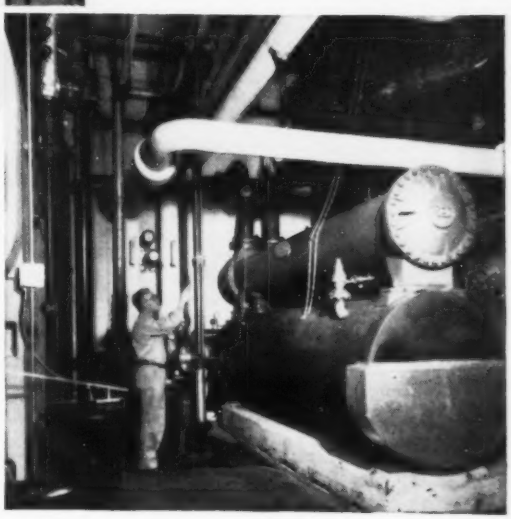
Salt Lake City's new First Security Building is ultra-modern in more than just appearance. It features dual zone air conditioning in which *steel pipe* serves for the steam, chilled water and condenser water lines throughout the 12-floor *heating and cooling* system. Nearly a mile of steel pipe—40,000 pounds—from the basement boiler and chiller installation to the penthouse condensers was required.

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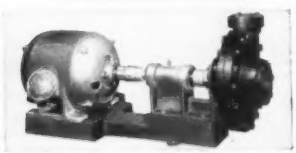
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be able to revise the constitution without changing the charter.

Dornblatt said the constitutional clause which refers to lobbying also is being deleted. Several months ago, the Engineers Joint Council temporarily tabled the application of the Consulting Engineers Council for membership. This was done because the clause in the CEC constitution referring to lobbying possibly could have given the EJC troubles if it obtains a tax-free classification. The EJC has been notified of the CEC constitutional changes.

Dornblatt also was chairman of the Council's original Errors and Omissions Insurance Committee. This committee recommended that the Council obtain Lloyd's of London insurance because no American firm indicated at that time that it could give errors and omissions coverage in all 48 states. Then, last year, Dornblatt was a member of the executive board which recommended that the Council change its errors and omissions group policy to the Fidelity & Casualty Co. Dornblatt also was instrumental in getting the Fidelity & Casualty Co. to retitle its errors and omissions policy so that it became known as an engineer's rather than an architect-engineer policy.

Although he is a staunch CEC advocate, Dornblatt would like to see unity through EJC with all "splinter" engineering organizations eliminated.

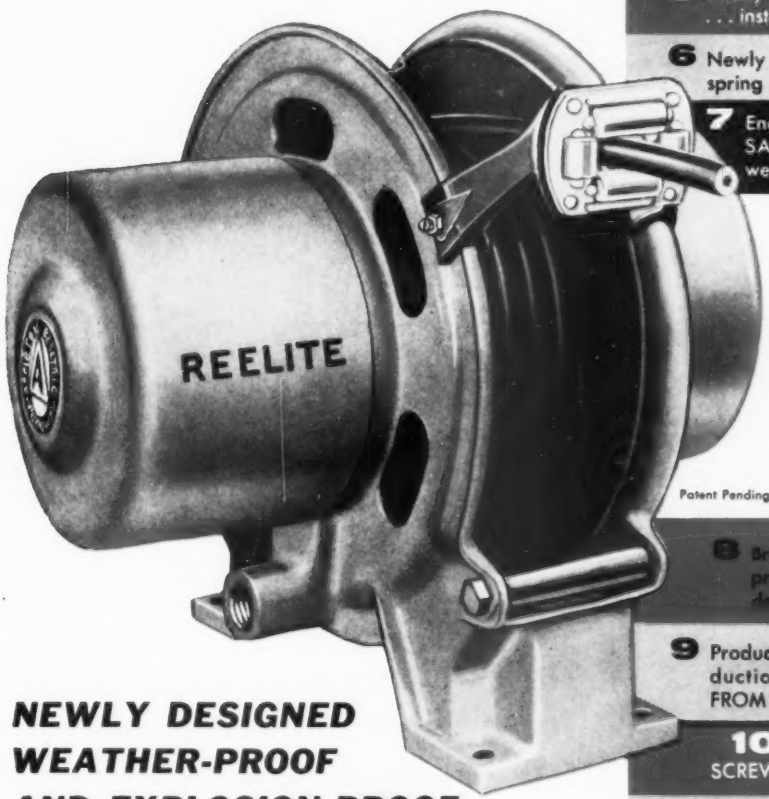
"By splinter groups, I am talking about some of the technical societies and organizations which do not place an emphasis on professional problems. I do not consider the CEC a splinter group. It is different because it is a management organization for the improvement of business conditions and relationships," he explained.

Active in Engineering Organizations

When Dornblatt speaks of "too many engineering organizations," he speaks from experience.

In addition to a number of civic organizations, he is active in the American Society of Civil Engineers, the American Institute of Consulting Engineers, the Society of American Military Engineers, the Louisiana Engineering Society, the American Concrete Institute, the American Railway Engineering Association, the American Road Builders Association, the Highway Research Board, the Permanent International Association of Navigation Congresses, the International Association of Bridge and Structural Engineering, the U. S. National Council on Soil Mechanics and Foundation Engineering, the Urban Land Institute, the American Institute of Management, the American Waterworks Association, and the Engineers Club of New Orleans. He also has served as president, Louisiana Section, ASCE; the Gulf Institute, and the Louisiana Post of Military Engineers. He currently is a member of the Louisiana Institute of Civil Engineers and the Consulting Engineer Council boards, and he formerly was a member of the board of directors of the New Orleans Engineers Club. ▲▲

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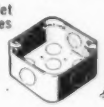
APPLETON ELECTRIC PRODUCTS®

Also Manufacturers of:


Malleable Iron Unilet Fittings


Explosion-Proof Fixtures

Outlet Boxes




Industrial Lighting Equipment



The new Walt Whitman Bridge. Consulting Architects: Harbeson, Hough, Livingston and Larson, Philadelphia. Consulting Engineer: George S. Richardson, Consultant to Turnpike Commission.

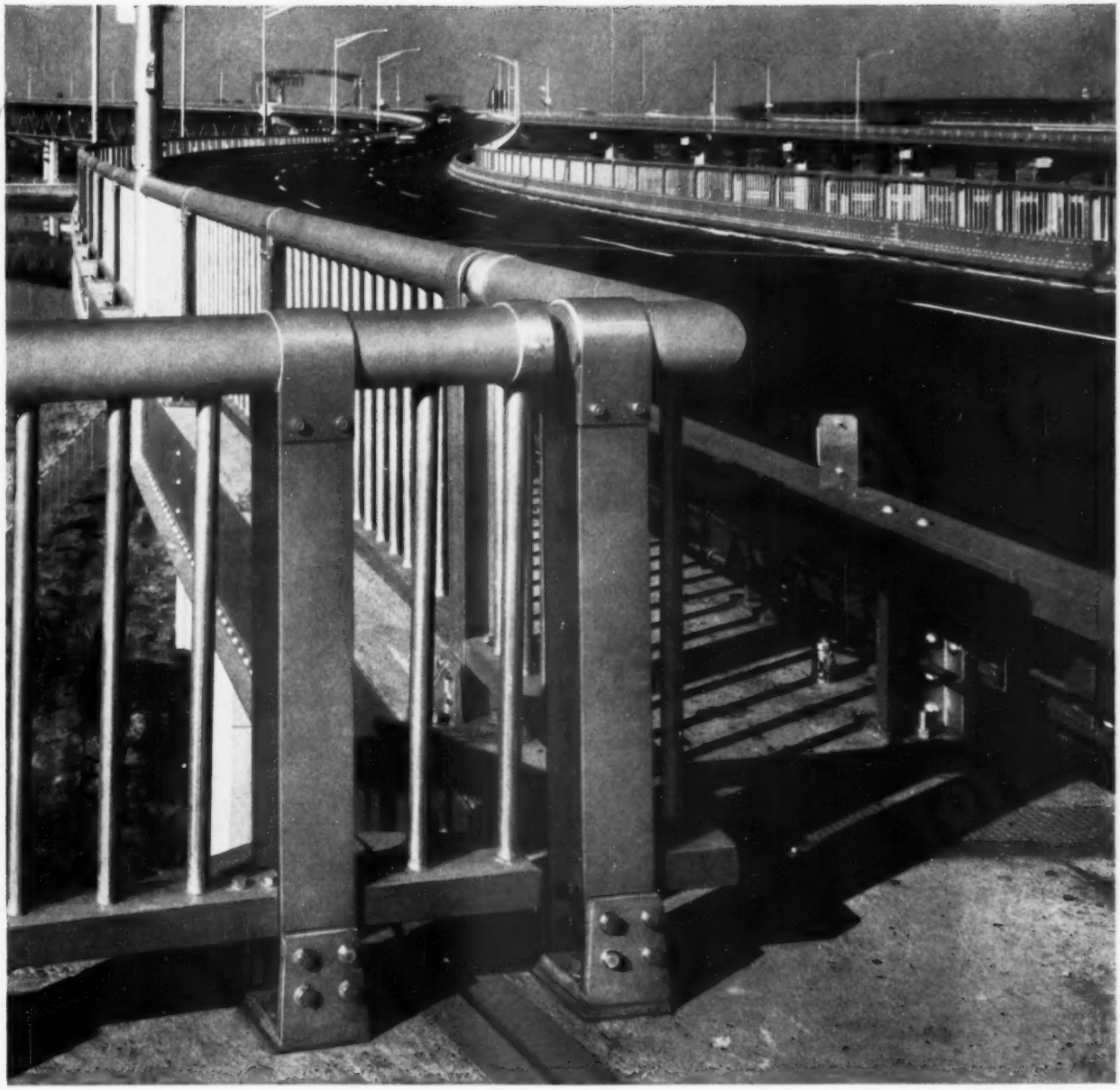
Photo taken during construction shows a two-man team installing prefabricated Flynn railing sections on the Walt Whitman Bridge. Work is clean, fast, easy—no need for heavy equipment or hoists.

NEW WALT WHITMAN BRIDGE:

Prefabricated Flynn railing cut days

The magnificent new Walt Whitman Bridge, reaching across the Delaware River between Philadelphia and Gloucester, N.J., has put Flynn first in bridge railing news again. To save erection time for the contractor, ten-foot-long sections of prefabricated Flynn post and rail were delivered direct to the job site, ready for fast, easy installation. With wrenches as their principal tool, a two-man-team put thousands of feet of this low-cost, lightweight aluminum railing in place—quickly, easily, and without power lifting equipment.

Years from now, these handsome Flynn extrusions will still be serving and saving money for the bridge authority. Because they can't rust, or rot, they'll never need painting or require costly maintenance.



Photograph by Cortlandt V. D. Hubbard

and dollars off construction costs

See this Walt Whitman Bridge railing in Flynn's free catalog. The baluster-type railing used on the Walt Whitman Bridge is one of many *standard designs* you'll find in Flynn's new bridge railing catalog. This valuable working tool contains details on dozens of "job-proven" profiles available to you for distinctive, low-cost bridge and highway construction. *For your free copy, write on your letterhead to Flynn's main office. Meanwhile, if you're planning a project at present, call the man from Flynn. He'll help you select the right railing, right away.*

MICHAEL FLYNN MANUFACTURING COMPANY
Aluminum Division

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Sales Offices:
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937 RADCLIFFE ROAD, TOWSON, MD. ..... Tel.: VAlley 3-2090
133 MAPLE STREET, SPRINGFIELD, MASS. ..... Tel.: REpublic 3-2814
672 SOUTH LAFAYETTE PARK PLACE, LOS ANGELES 57, CALIF. Tel.: DUnkirk 7-3183
THOMAS BLDG., 1314 WOOD ST., DALLAS 2, TEXAS ..... Tel.: RIverside 8-5935

FLYNN ALUMINUM

The Reader's Guide



Practical Approach To Atomic Design

A number of good articles on nuclear engineering have been published in recent months. In fact, there have been several excellent ones in this magazine. Most of these have dealt with fundamentals of nuclear reactor theory. None have really attempted to guide the consulting engineer in the practical solution of problems of design and specification preparation. Now, Wilbur E. Kelley, president, and Frederick A. Zenz, development engineer, of Walter Kidde Nuclear Laboratories, Inc., have put together an article that will be of direct aid to all consulting engineers dealing with nuclear installations. The authors cover the entire range of engineering work from the site selection through to detail design and specification of materials for power installations. We feel that from the consulting engineer's point of view this is the best article on the design of nuclear projects that has yet been published. It starts on page 110, under the title "Nuclear Engineering for Consultants."

Professional Promotion

Val Laughner, author of the article "Promoting Your Firm – Professionally," thinks that the traditional "let the client seek me" is outmoded and never was very practical. He agrees that the consulting engineer must be extremely careful in his approach to publicity and sales promotion activity, but he points out that there are many effective methods open to the private practitioner – methods that are accepted as eminently ethical. The Survey of the Profession conducted by this magazine and published in our January and February issues points out clearly the need for more understanding of the role of the consulting engineer by the general public and special client groups. There is a need for an educational program in which not only the engineering societies but individual firms participate. Mr. Laughner's article, starting on page 102, will help you set up a dignified promotion program designed to benefit not only your own firm but the whole profession.

A Degree of Logic

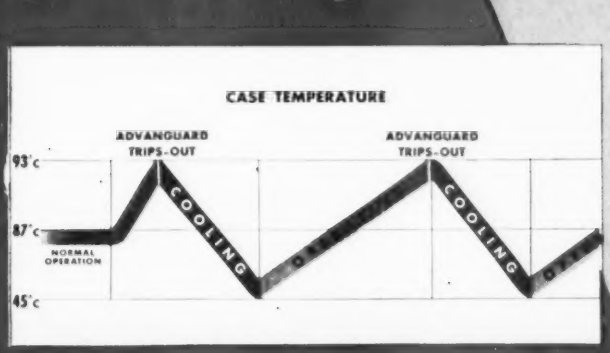
Very little is being published these days on the history of science. Yet, we have found that the few historical articles we have carried have been most excellently received by our readers. It would seem that engineers, consulting engineers in particular, are really interested in their scientific heritage and the work of earlier scientists. D. J. Lovell, whose hobby is scientific history, undertook a search of the literature to see if he could find out how Fahrenheit hit upon his seemingly strange selection of the unwieldy numbers 32 and 212 to signify the freezing and boiling points of water. The generally accepted explanations in encyclopedias and other general reference works did not appear convincing. Further research showed that if these reference points are odd, the way in which they were derived was, if not always logical, at least understandable. Lovell also points out the curious fact that of the three modern thermometer scales, not one is used in the native land of its originator. For other interesting background information on thermometers see, "How Fahrenheit Fixed His Scale," starting on page 96.

Perspective Data

Elwyn E. Seelye, of Seelye Stevenson Value and Knecht, warns engineers that all of the data they need in highway work is not included in the textbooks. In fact, he says that many engineers could make good use of what he calls "perspective data." This is general knowledge that can seldom be put down in tables or charts. In his article, "Perspective Data on Paving Design," starting on page 86, Mr. Seelye draws upon his many years of experience to provide other engineers with perspective data he has gathered. This is a valuable addition to highway literature.

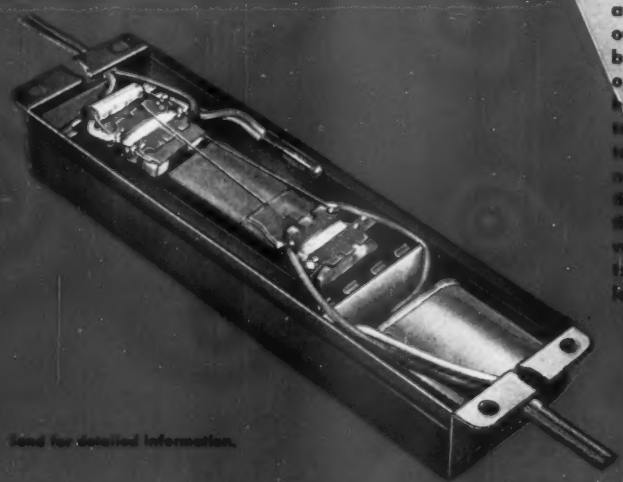
STOP BALLAST OVERHEATING

HERE'S WHY **ADVAN** *guard* CAN INCREASE BALLAST LIFE



The life of a fluorescent lamp ballast depends on maintaining a normal operating temperature. For each 10° C. increase over normal operating temperature, ballast life is cut in half. Each subsequent 10° C. rise cuts ballast life again in half and increases costs accordingly.

ADVAN-guard, a thermally-actuated automatic reclosing protective device is sealed in the ballast housing and is preset to automatically 'trip-out' whenever the fluorescent lamp ballast operates at abnormal current or temperatures. When the current or heat decreases to normal operating temperatures, this protector resets automatically and the ballast resumes normal operation. If overheating continues, ADVAN-guard protection continues. Thus ADVAN-guard, by preventing ballast operation at abnormal temperature, can add years to ballast life.



Send for detailed information.

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World's Largest Exclusive Manufacturer of Fluorescent Lamp Ballasts

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Piping System Analysis

Like so many other aspects of engineering design, the layout of piping has become more technical in recent years. The analysis of piping systems is today a special technical operation. One of the real experts on piping analysis in this country is Lale Clark Andrews, who operates his own model pipe test laboratory, in Stella, Nebraska. This is the laboratory formerly owned by the M. W. Kellogg Co. In his article, "Analyzing Complex Piping Systems," starting on page 123, Andrews explains the best approach to the analysis of various types of high pressure, high temperature piping systems. He points out that some types can be handled quite easily and economically by mathematical computation, solutions being provided by desk type or electronic calculating machines. Other systems can be analyzed more economically by test models. Andrews also includes in his article a list of design details that have become identified as potential troublemakers. A check of these can be most helpful to the consulting engineer involved in piping layout and specification.

New Data for Pier Design

E. Czerniak is design engineer and supervisor at The Fluor Corp., engineers and constructors. Recently he became interested in the design of piers and he found that there was relatively little information available of a reliable engineering nature. Czerniak made a thorough study of the mathematics involved, and he prepared for us an article presenting the results of his research. We feel that this article is a real contribution to engineering literature, and all of our readers dealing with problems of this nature will find here solutions that go beyond anything previously published on the subject. This is the kind of material that should be in your technical reference files, and we will be glad to supply you with an extra reprint of "Design Criteria for Embedment of Piers" (see page 90) if you write us.

Eyeless in Gaza

Our Austrian correspondent, Rudolph Sobotka, has made use of hindsight to prove that Russia has been anything but secretive in warning the West of her scientific developments. By going through the news releases of the past few years, Sobotka finds that the Russian satellite program was one of the best publicized scientific activities of the century – if we had just understood what the Russian releases meant and had taken them seriously. Sobotka feels that the knowledge we now have of how Russia releases scientific news can be an excellent guide to what we may expect from her in the future. On this premise he has analyzed current Russian scientific news, and he comes up with an interesting list of developments on which Russian scientists are likely engaged. By no means all of these research projects will be successfully completed, but Sobotka claims that we cannot be surprised by those that do come through – as we were surprised by the satellites. A Russian word to the wise should be sufficient warning for the West. ("How Russia Releases the News," page 134.)

Lee on Atoms

This month we are starting a new type of department under an old and familiar title. "Atoms in Action" will no longer be composed of short news items but will instead be a by-lined column prepared by John F. Lee, Distinguished Professor and Graduate Administrator, of North Carolina State College. There is a reason for this change. We felt that the space in a monthly magazine could be devoted more profitably to an informative column than to brief news items. Most of the atomic news items of any importance are carried in the daily newspapers or in weekly news magazines, and it always has been the policy of this magazine to try to provide its readers with material not available elsewhere. For this reason we are leaving atomic news to the newspapers and we will henceforth turn this space in our publication over to Lee for his thoughtful and stimulating comments summarizing developments in nuclear engineering and related fields. This month's new "Atoms in Action" starts on page 146.

DETROIT EDISON COMPANY
Insulates to get More Useful Heat . . . with
BALDWIN-HILL MONO-BLOCK®



To save every possible Btu for power generation, Detroit Edison selected thermally efficient B-H Mono-Block for insulating furnaces and waterwalls.

Because B-H Mono-Block is felted of high temperature-resisting spun mineral wool fibers, it provides extremely low thermal conductivity in one block over the full range of temperatures to 1700° F. This block also facilitates and speeds application due to its light weight and ease of cutting to any shape required.

At Detroit Edison's Conners Creek and St. Clair power plants, B-H Mono-Block, in size 18″ x 24″, 3″ thick, was secured tightly against the refractory cement boiler covering by tie wires fastened to horizontal pencil rods. Joints between the blocks were pointed with B-H No. 1 Insulating Cement to form an unbroken layer of effective insulation.

See the B-H catalog in Sweet's Plant Engineering File



BALDWIN-HILL COMPANY

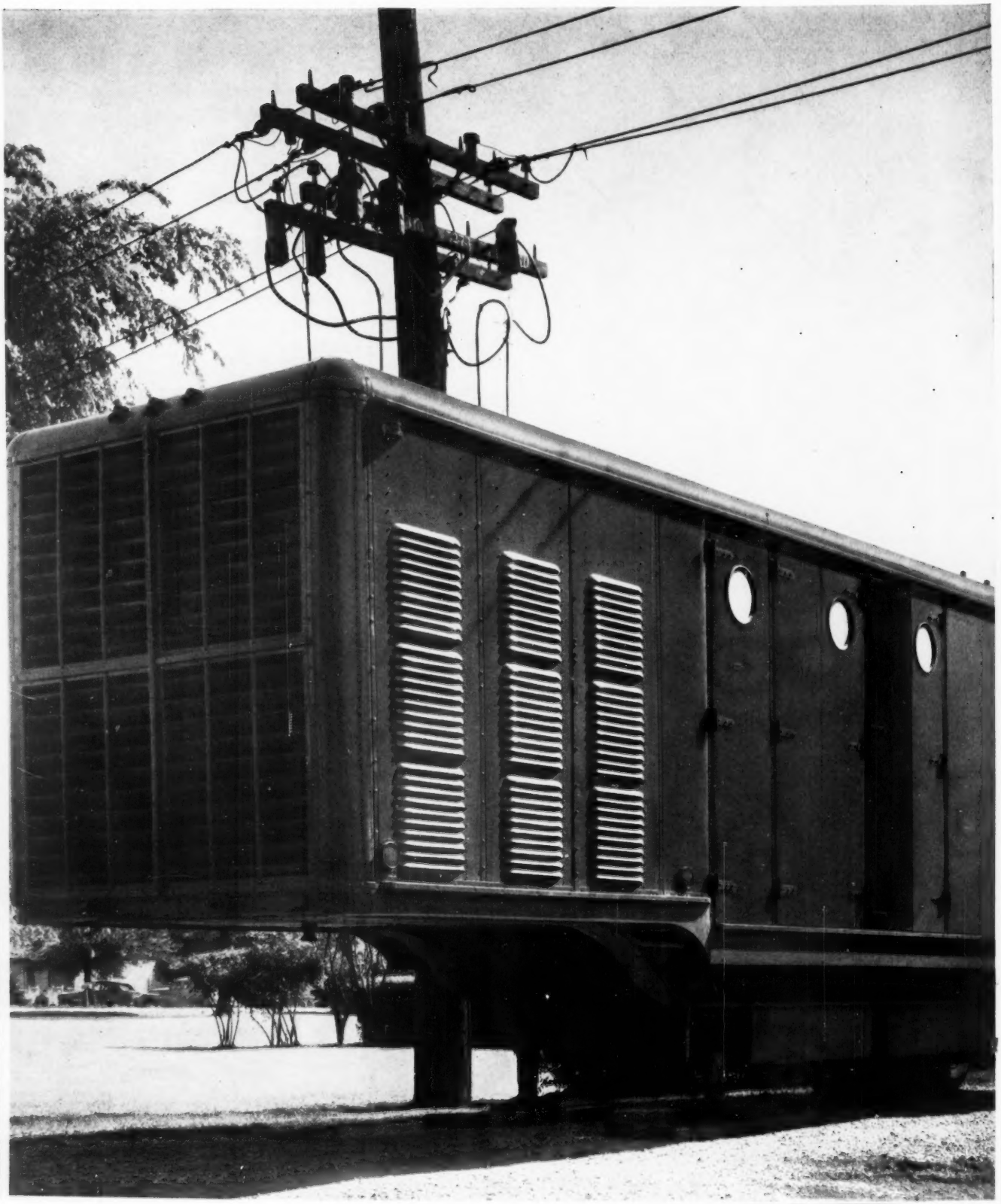
Complete line of Industrial Insulations

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Write for new 1958 brochure on B-H Mono-Block and its companion product, B-H Improved Super Powerhouse Cement.

Line relocation



need not be costly



Not, that is, when work can be completed during regular hours and without interrupting service. And many utilities are doing just that—paring the high cost of line relocation and other maintenance and repair needs—with versatile Electro-Mobile generating units.

For example, a 500 kw trailer like the one shown here can travel most anywhere, pick up a load in minutes. Crews can do their work faster, at lower cost, and all the while *normal service* is maintained.

Further, these units can be utilized as an immediate source of emergency power. Their quick mobility can provide the means to continued service, and continued good public relations.

The economies of Electro-Mobile Power have been demonstrated on many utility applications. Why not ask your Electro-Motive representative to outline briefly ways these trailer units can help improve service and lower costs for your system?



1000 kw units for use on sidings or placed on piers for semi-permanent use.



500 kw units offer excellent mobility for many temporary applications.

LIVE BETTER ELECTRICALLY

ELECTRO-MOTIVE DIVISION
GENERAL MOTORS
LA GRANGE, ILLINOIS
Sales offices in Chicago, New York, St. Louis, San Francisco
In Canada: General Motors Diesel Limited, London, Ontario

Textile processor finds



fuel cost solution in coal

Kerr Bleaching & Finishing Works' modern equipment cuts steam costs 33%, manpower 67%.

A reliable source of steam is a necessity in bleaching and finishing textile products. So when production demands at Kerr Bleaching & Finishing Works, Concord, N. C., called for additional steam capacity, the firm decided to build a new power plant. Coal was chosen as the fuel on the basis of cost studies.

A new boiler and modern coal handling system were installed. Automatic controls regulate the operation. The results were a 50% increase in steam capacity and a 67% reduction in manpower . . . with overall fuel and operating costs cut over 33%!

This modern unit was so successful—providing trouble-free operation and low-maintenance cost—that when even greater capacity was needed, an identical new unit was added. And, of course, no increase in operating crew was necessary!

Facts you should know about coal

Not only is bituminous coal the lowest-cost fuel in most industrial areas, but up-to-date coal burning equipment can give you 15% to 50% more steam per dollar. Today's automatic equipment pares labor costs and eliminates smoke problems. And vast coal reserves plus mechanized production methods mean a constantly plentiful supply of coal at stable prices.

Technical advisory service

All companies planning a new power plant, or the remodeling of a present one, should consult an engineering firm on its design and construction. As a matter of fact, every Bituminous Coal Institute advertisement advises its readers to take this step. When you have such a problem, our Engineering Staff will be glad to assist you in your fuel cost survey with any coal information you may require.

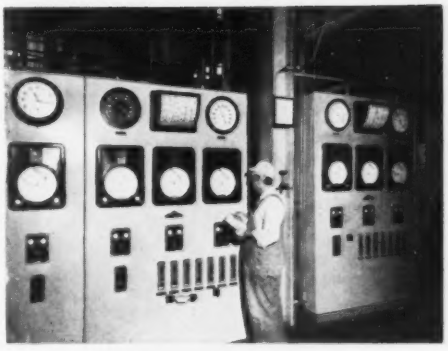
Meanwhile, we believe you will be interested in our informative case history booklet, complete with data sheets. Write to the address below for your copy.

BITUMINOUS COAL INSTITUTE

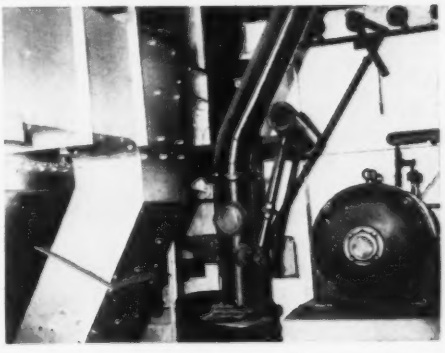
Southern Building • Washington 5, D. C.



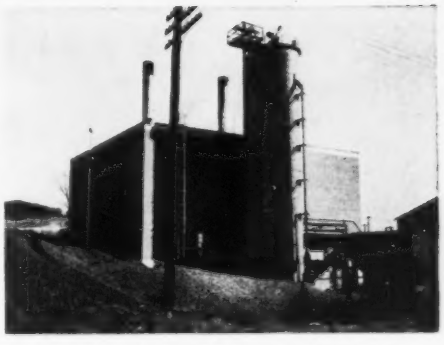
Firing aisle at the power plant of Kerr Bleaching & Finishing Works, showing two Babcock & Wilcox 60,000 lb/hr boilers—the more recent on the right. Fired by Detroit spreader-type Rotostoker, with steam-powered dump grates.



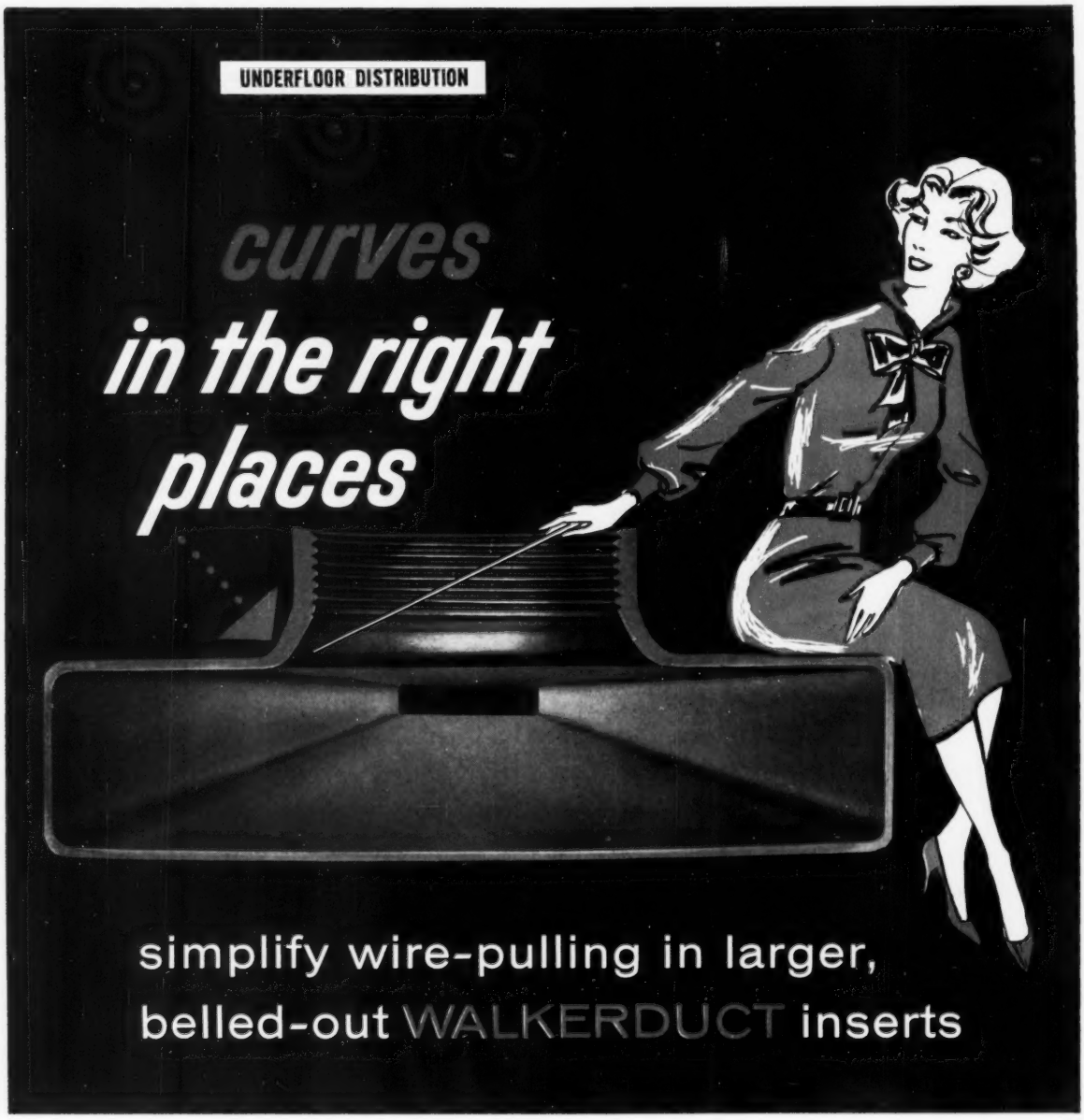
Control panels of Bailey Pneumatic Control System. Fuel feed, draft dampers, feedwater control—entire combustion operation is automatically regulated by this system.



View in rear of Boiler No. 2. Pipe in center of photograph returns fly ash from collector to furnace to be burned again. Motor on the righ drives induced draft fan.



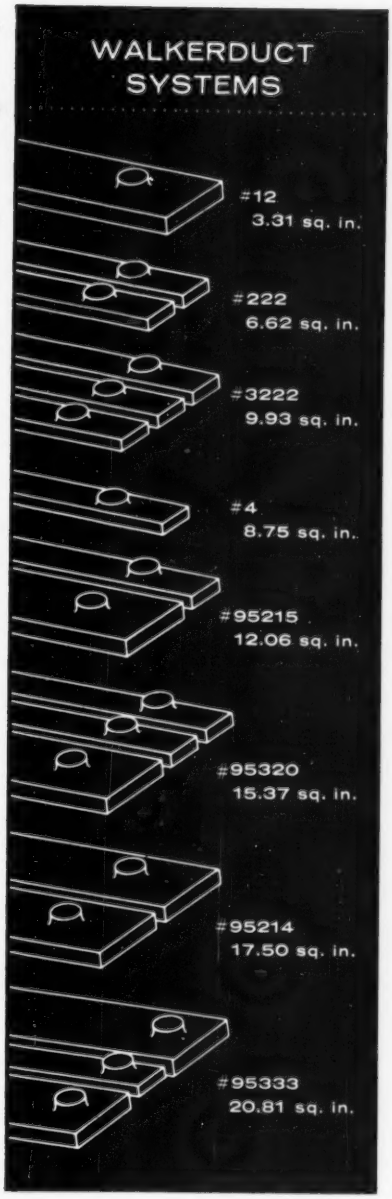
Rear of Kerr's power plant showing the 250-ton coal storage silo. Coal is dumped into hopper by railroad car and carried by horizontal conveyor to bucket elevator at silo. Reserve coal pile is shown at left.



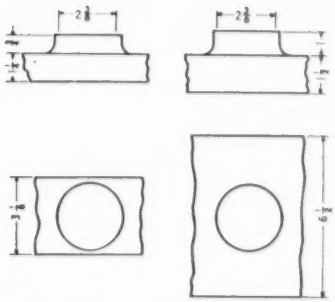
Faster installation is one advantage of these new, larger Walkerduct inserts ... with belled-out bases that enable wire and cable to slide through more speedily. *Greater safety for cable and wire* is another feature, since there's virtually no risk of damaging insulation during installation.

With inside diameter of 2⅜" (compared to former 1.9" I.D.), inserts are generally spaced on 24" centers. Minimum heights: ¾" on No. 2 duct, 1" on No. 31400 duct. Greater heights available as specified. Open end of each insert is sealed with a removable steel cap, recessed to receive concrete. Want further information on Walkerduct Systems and component parts? Write for Catalog 354 I. Walker Brothers, Conshohocken, Pa.

WALKER
OF CONSHOHOCKEN



STANDARD AND LARGE CAPACITY WALKERDUCT



CAT. NO. 2 DUCT

CAT. NO. 31400 DUCT



Readers' Comment

Sir:

I read with interest the report on "How to Prepare Catalogs for Consulting Engineers."

Some of the thoughts in this report by the Committee of One-Hundred are good, but I must take exception to the one regarding dimensional specifications.

An example is given where a switchboard was specified using the dimensional drawings in a catalog and then the equipment would not go down the stairwell. It is fine to point out that the manufacturer of the switchboard was at fault but as an editor you should be pointing out to your readers that they were in error and more than that, "stupid" to design a switchboard around a manufacturer's literature.

You should stress the point that only "certified prints" should be used in the final design of anything. Literature is distributed for estimating purposes and for general layouts, but it is obvious that the manufacturer cannot carry the responsibility for the final design.

This is another example of over-generalization in industrial editing and too often the vanity of your readers is played up to. Let's tell your readers what they ought to know for their own good and not recite their idea from their own side of the desk, and let's not play up the idea too strongly that engineers are finicky people.

The above doesn't mean that De Laval doesn't like the magazine CONSULTING ENGINEER because we think you are doing a good job. This is written merely as a constructive criticism.

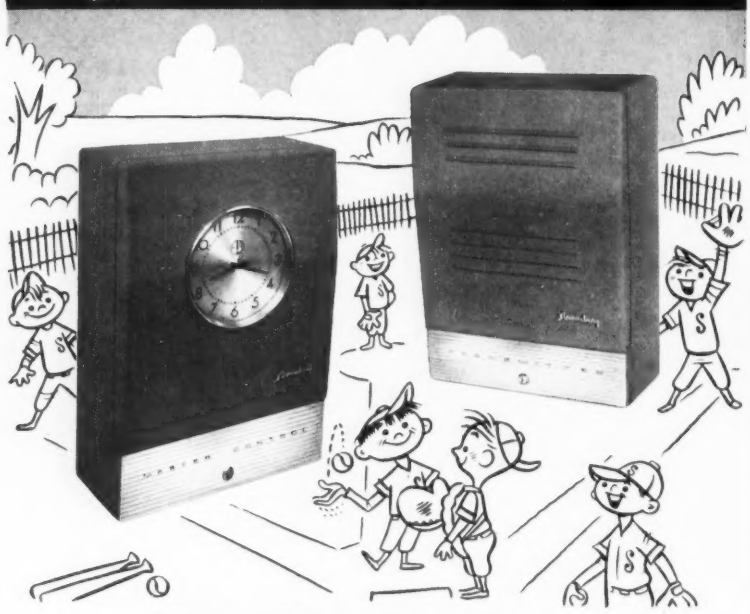
F. H. Story
Advertising Manager
De Laval Steam Turbine Co.
Trenton, N.J.

Sir:

I have read the "Heard Around Headquarters" section of the January issue of your publication and also have read Mr. Walter J. Barrett's article, "Unity of the Engineering Profession," in the January issue of *Power Industry*. It is still not clear to me who is leading who in the task of clarification and unification of aims and professional bounds of the purely professional engineer. By professional engineer I am thinking of one engaged in engineering work and not dependent on any interests or efforts on the part of other individuals or groups for work.

The contentions of the Founder Societies, EJC, ECPD, NSPE, CEC, etc., are quite confusing to me and it would appear that each group is extending efforts to keep the others from gaining an advantage, rather than mending its own fences where there is need for mending. Perhaps the best solu-

a TEAM that can't be beat!



Stromberg's new Electronic Time System performs beyond compare...

Here are some (just a few) of the many PLUS features not offered by others

- Jewelled Master Clock movement with automatically wound 72-hour spring power reserve.
- Secondary Clocks standard with hourly and 12-hour supervision — correction cycles completed in *only 60 seconds.*
- Program Unit, capable of 1440 signals daily on each circuit, immediately resets following power interruption.
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- Seven-channel transmitter — one for clock supervision, six for program signals.
- Installation and maintenance service available throughout U.S.A. and Canada.

A product of the laboratories of one of the largest clock manufacturers in the world—*YOUR GUARANTEE of performance, quality and dependability.*

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tion would be for all engineers engaged solely in consulting work, regardless of membership in Founder Societies or NSPE, to assemble at a national convention and stay in session until all major problems are solved and all have agreed to abide by the measures adopted by the convention. Firms engaged in both architectural and engineering work might have to choose their affiliations — AIA or Engineers.

The January issue of the CEC Newsletter tells of CEC Code of Ethics you have furnished to their headquarters in Springfield, Ill. The letter states that the Code as furnished is being distributed with the Council Yearbook. I cannot be a member of the Council since there is no Indiana Association formed as yet, but I should like to have a copy of the Code (suitable for framing) if you are in a position to supply it. I believe that Mr. Hueston M. Smith, St. Louis, would authorize one for me if such procedure should prove to be necessary.

I should appreciate your comments about the possibility for organizing the consulting engineers that they might function independent of groups devoted to technical interests only.

Clement L. Kline
Practicing Mechanical Engineer
Indianapolis, Ind.

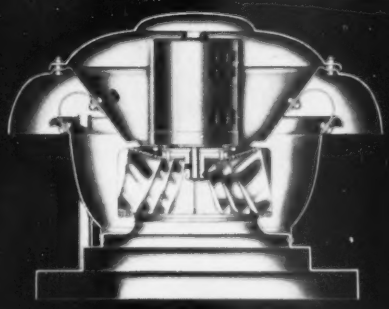
Sir:

My attention has been directed to an excellent article entitled "How to Write Engineering Specifications," prepared by the Committee of One-Hundred, and published in the July 1957 issue of CONSULTING ENGINEER. This article is of considerable interest to our membership which is principally composed of practicing architects, engineers, and specification writers. It is also directed toward the chief goal of the Construction Specification's Institute, the improvement of construction specifications.

In view of the importance of the article cited, I am requesting

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OVER 50,000 CASE HISTORIES CAN'T BE WRONG!



Jenn-Air Quiet-Tested Centrifugal Direct Drive Roof Exhauster, with U-Spring Suspension Mounting. U-Springs suspend the power assembly, isolate it from the base. Noise caused by vibration is virtually eliminated.

Why U-Spring Cushion Suspension Mounting... by JENN-AIR...has now been adapted to JENN-AIR Axial Roof and Centrifugal Wall Exhausters



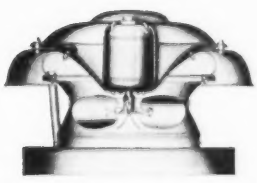
Jenn-Air Quiet-Tested Centrifugal Wall Exhauster, with U-Spring Suspension Mounting. Eliminates most duct work. Provides a means of ventilation through the wall.

The Facts: Two years ago Jenn-Air incorporated U-Spring Cushion Suspension Mounting in its Quiet-Tested Direct Drive Roof Exhausters. Since then, over 50,000 units have been installed.

The Facts: Not a single failure has been reported. No breakage on record. No instance of shipping damage (wheel binding into inlet), a common occurrence in rubber insulated ventilators . . . Jenn-Air U-Springs absorb the shock of rough handling. Only six recorded cases in 50,000,where the U-springs failed to solve the noise problem.

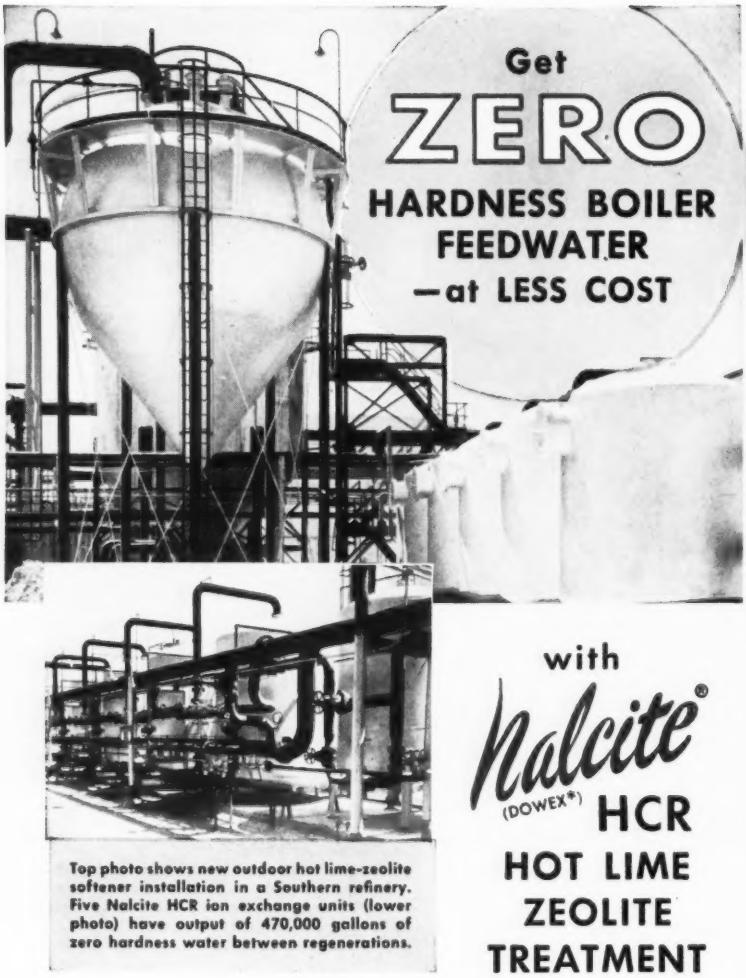
The Facts: U-Spring Cushion Suspension Mounting – which shows 44% less vibration transmission than rubber or neoprene – has now been adapted to Jenn-Air Axial Roof and Centrifugal Wall Exhausters. Another in the long line of Jenn-Air "firsts" that includes: *first* with *true* low contour design . . . *first* with spun aluminum construction . . . *first* with Quiet-Testing in Jenn-Air's exclusive Sound-Elec Test Chamber . . . *first* with motors lubricated for ten years of normal operation.

The Facts explain why you can look to Jenn-Air for quality-engineered exhausters that never wait for the rest of the field to catch up.



Jenn-Air Quiet-Tested Axial Roof Exhauster, with U-Spring Suspension Mounting. Recommended for general ventilation work and duct-type application.

JENN-AIR PRODUCTS COMPANY, INC.
1102 Stadium Drive, Indianapolis 7, Indiana
MEMBER, AIR MOVING AND CONDITIONING ASSOCIATION



Top photo shows new outdoor hot lime-zeolite softener installation in a Southern refinery. Five Nalcite HCR ion exchange units (lower photo) have output of 470,000 gallons of zero hardness water between regenerations.

Start with the simplicity of operation . . . add the low operating costs of hot lime-zeolite softening . . . all made possible by the outstanding high-temperature performance of Nalcite HCR in the zeolite softeners. Results: Zero hardness water, from virtually any raw water source, with a minimum of testing and control required. See your water treating equipment manufacturer for details on new or conversion hot lime-zeolite treatment for your plant . . . and for top softener efficiency, specify Nalcite HCR.

*Reg. Trademark of The Dow Chemical Company

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Nalco® PRODUCTS

When you use Nalcite resins, you take advantage of Nalco's long and broad experience in water and process technology.

permission to reprint it in our quarterly publication, the *Construction Supervisor*. Full credit would be given the authors and to your publication.

Your cooperation will be sincerely appreciated.

Carl J. Ebert
Construction Specifications Institute
Washington, D.C.

Sir:

The October 1956 issue of CONSULTING ENGINEER included a reference to the MACE "Code of Practice for Preparation of Electrical Plans and Specifications." We are happy to report that copies of this code are now available for distribution. The price is 25¢ per copy. We shall attempt to honor all future requests as soon as they are received . . . all requests for copies should be made to Wilbert F. Rath, P. E., Treasurer, MACE, 1946 Railway Exchange Building, St. Louis 1, Missouri.

Wilbert F. Rath
Treasurer
Missouri Association of Consulting Engineers

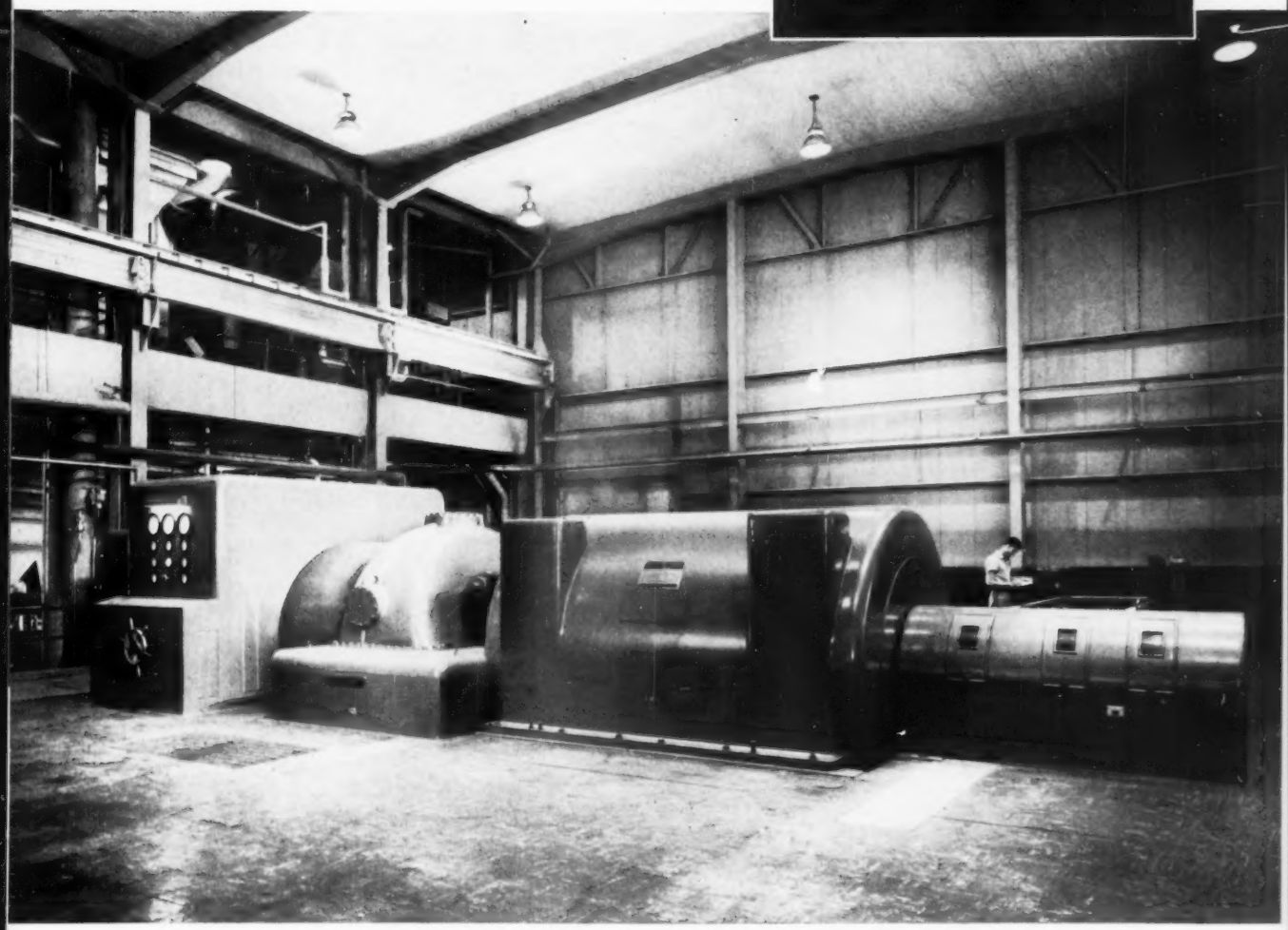
Sir:

Specializing in school engineering (heating and ventilating, electrical, sanitary and water supply, and sewage disposal), this firm, established over half a century has designed the engineering work in the categories mentioned for over 500 schools, and commends the editorial Scraps & Shavings in the November issue, particularly in relation to "plant."

The writer believes that the American people are even more susceptible to propaganda than those in totalitarian countries in that they readily accept almost any new idea or product — particularly through over enthusiastic advertising — that appeals to their imagination. Freakish gadgetry, unnecessary luxuries, and maximum automaticity can result in needless capital and maintenance expense in construction. At

Henderson, Ky., selects a third

DE LAVAL
TURBINE
GENERATOR



In 1950,...
two De Laval 5,000 kw multi-stage turbine generators were installed in the central station of Henderson, Kentucky. These units operated so dependably that the City of Henderson ordered a new, larger De Laval turbine generator to meet their increased power requirements.

Put on the line in 1956,...
this 12,650 kw De Laval machine is an AIEE-ASME Preferred Standard Unit. It operates at 600 psig and 825F; the turbine speed is 3,600 rpm.

De Laval multi-stage turbines are rugged in construction, economical to run. Transmission of power may be either direct or through speed reducing gears. De Laval multi-stage steam turbines are available for all services, including operation at the high pressures, high temperatures employed in steam plants of the latest design. Units are built in sizes up to 25,000 hp.

DE LAVAL *Turbine Generators*

DE LAVAL STEAM TURBINE COMPANY
894 Nottingham Way, Trenton 2, New Jersey

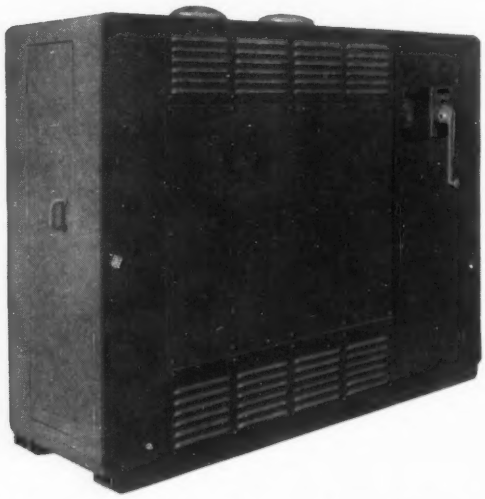


DB LEVEL BELOW NEMA STANDARDS

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SIX WEEK DELIVERY

STRAIGHT TALK ABOUT LO-TEMP* LOAD CENTERS



There's lots of talk about off-the-shelf transformers today, but you specify load center transformers and you know that the unit that just meets today's needs causes trouble when the load increases tomorrow. When the transformer is designed with plenty of good steel and copper to safely carry unanticipated overloads, the job is safe and your reputation is safe. You make no expensive trouble calls.

Lo-Temp units meet these needs. They are safe far beyond their rated capacities and they perform at temperatures and noise levels below NEMA standards.

You can have your load center transformers designed to your requirements; to match new switchgear, existing switchgear or with switchgear of your choice; and within almost any dimensional limitations at no greater cost than you'd pay for an off-the-shelf unit. Standard Transformer builds them. Prove it to your own satisfaction today. Call your nearby Standard representative or write directly to us. If it's a rush job call us direct.

*STANDARD LO-TEMP TRANSFORMERS PROVIDE EXTRA CAPACITY AT NO EXTRA COST.

LIVE BETTER ELECTRICALLY

Phone Warren 2-1563

Standard Transformer CO.

WARREN, OHIO

"WHEREVER THERE IS POWER"

this writing, manufacturers of ventilating units, for example, are pushing air conditioning for schools which feature, however desirable in really hot sections of the country, is surely not warranted in a large part of the land.

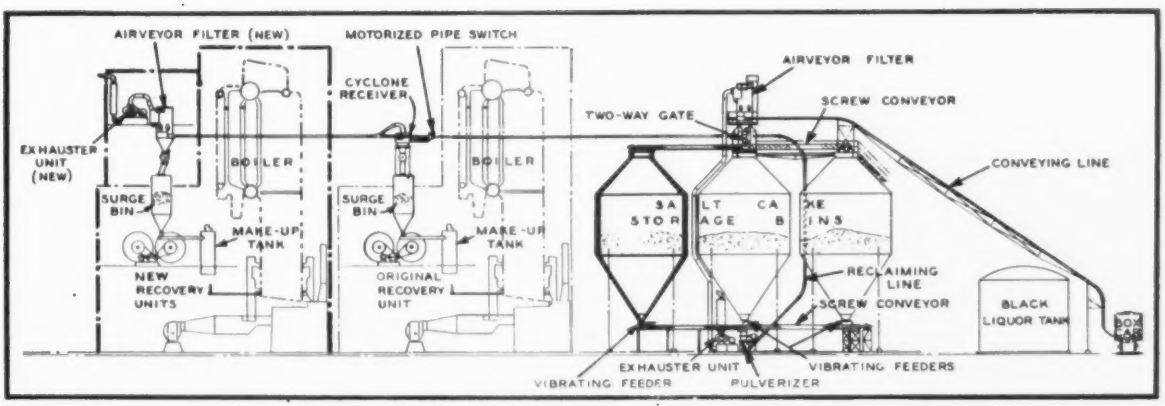
What most critics of school construction fail to realize is that in most enlightened sections the state education program establishes the criterion of cost. And this is not to criticize any such program, as to do so goes beyond the professional prerogative of the engineer. But the fact is that schools are primarily designed around and to house the program.

When the writer went through (public) high school, the only power tools were those of the "armstrong" variety. Today all shops necessarily require large investment in contemporary equipment which is not gadgetry, and similar outlay in varying amounts for other parts of the "program" such as homemaking, etc. To train today's pupils for today's world obviously requires the modern equipment with which the student must be familiar when graduating into adult life.

During the past five years, architects and engineers have had to hold the unit cost of their school buildings almost constant in order to meet the budgetary limitations, and while the general value of materials and equipment has risen considerably. This has been accomplished largely by using less durable items or newer, untried methods. Little further can be done now in this direction.

Lowering school construction costs can only be effected by changes in the educational program or by minimizing luxuries and the former may not be desirable. But alert members of boards of education can weigh a number of items and decide just how far on the plush side the taxpayers will go when it comes to such things as air conditioning.

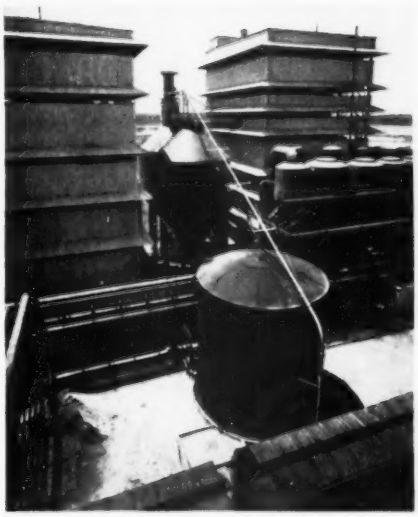
Malcolm E. Runyon, Partner
Runyon & Carey Associates
Newark, N. J.



Additions: Storage bin, center, shown in heavy line, and screw conveyors to and from bin. Left: recovery units, Airveyor exhauster unit and filter for reclaiming from storage for delivery to recovery units.

For expansion at St. Regis . . . Fuller had the answer

The above drawing illustrates how the St. Regis Paper Company, Jacksonville, Florida, increased its storage and conveying facilities at minimum cost and with little interruption in production.



Original Airveyor conveying system for both unloading salt cake from cars to storage and reclaiming from storage for delivery to recovery unit.

PROBLEM No. 1:
Original installation
Year 1952

Unload salt cake from box cars, convey to storage, reclaim from storage and deliver to recovery unit. Mill capacity, 300 tons of pulp a day.

SOLUTION:

The Airveyor conveying system was selected and installed to perform all of the above functions . . . a dual system using a single exhauster unit and filter for both unloading and reclaiming . . . only one of these operations to be performed at any one time. This method of operation was sufficient for all plant requirements at capacity then required.

PROBLEM No. 2:
Expansion
Year 1955

Increase of mill capacity from 300 tons to 1300 tons of pulp a day. This increase demanded additional recovery units, storage, and conveying alterations.

SOLUTION:

To continue using the original Airveyor system meant taxing the unit to its ultimate capacity, as well as congestion in the operation of the recovery unit, with little or no factor of safety. In order to provide satisfactory overall operation at all times, it was decided to divorce the reclaiming system and provide separate units, one for unloading and the other for reclaiming. This allows the operator of the recovery unit freedom of operation without interfering with the unloading operation. This change was accomplished by retaining the original exhauster and filter for unloading, extending the screw conveyors to serve the additional storage. An additional filter, exhauster, and conveying line transformed the reclaiming system to a separate and distinct unit. These changes to the Airveyor were accomplished at minimum expense, with very little interruption in production during alterations.

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A-239
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. . . . pioneers in harnessing AIR

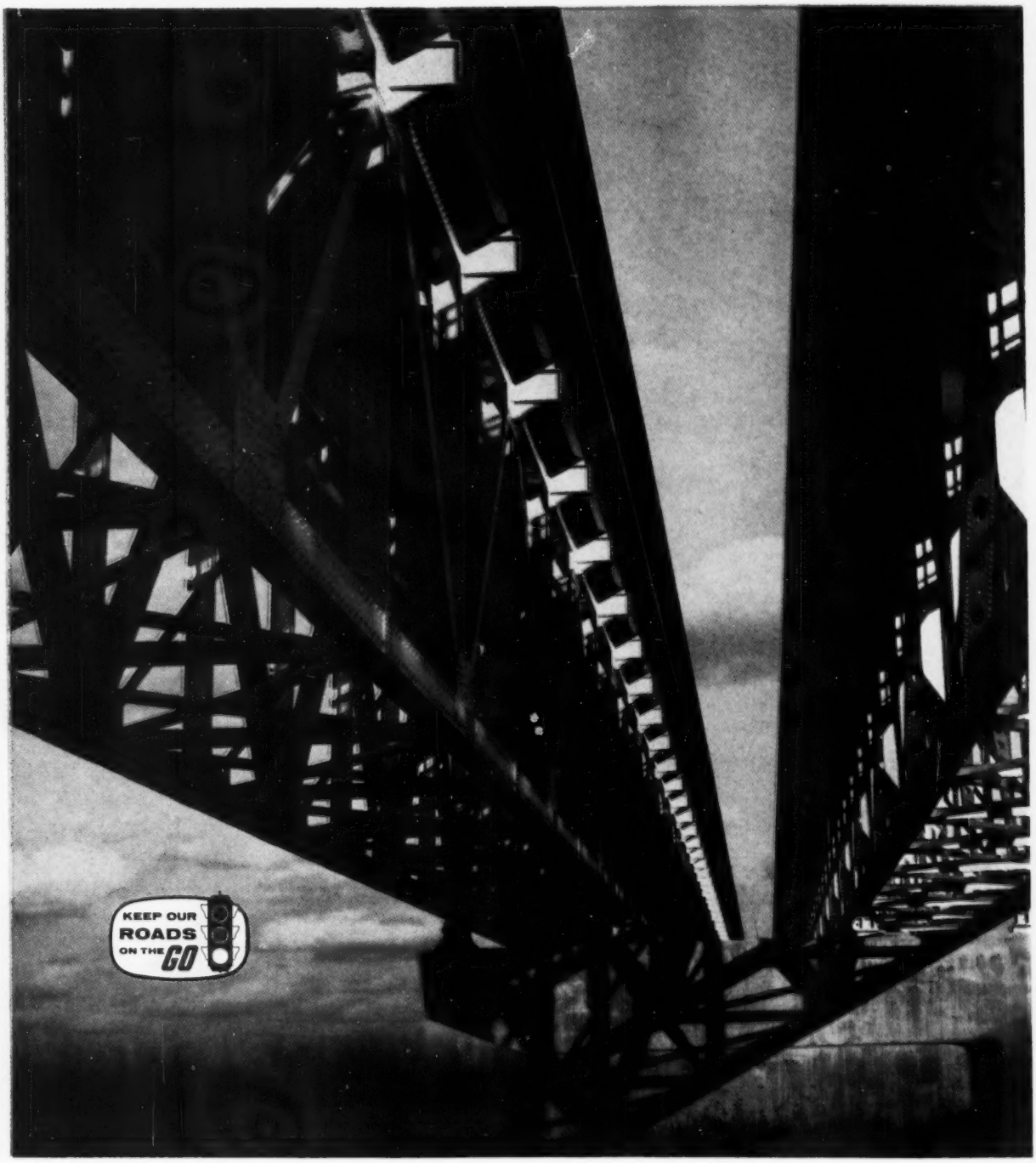
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Bridge builders save



These twin, continuous deck roadways span 2306' across the Kaw River, on 4310 tons of USS TRI-TEN Steel and structural carbon steel.

$100,000 with USS Tri-Ten Steel



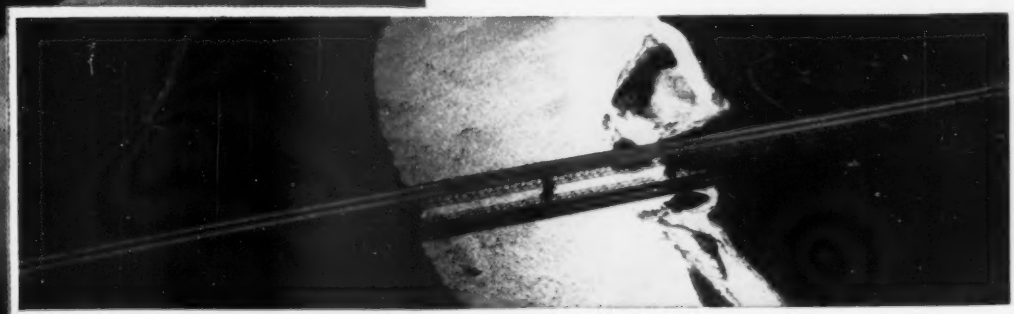
in the Kansas Turnpike's biggest bridge

THIS BRIDGE would have weighed 4,810 tons if it had been built entirely from structural carbon steel. Instead, the designers used USS TRI-TEN Steel for the more heavily stressed chords and diagonals. Because of the stronger steel, these parts could be made thinner, and lighter—*500 tons lighter,* with an estimated saving of *$100,000* in total steel costs.

TRI-TEN Steel members can be made lighter with no loss of strength because TRI-TEN Steel has a much higher yield point than carbon steel—50% higher in thicknesses of ¾" and less—and it meets fully all of the requirements of ASTM Specification A242 for High-Strength Low-Alloy Steels. Because lighter members can be used, dead weight can be reduced as much as 20%, freight costs are lower, and construction is easier.

For more information about construction for maximum strength and minimum weight with USS High Strength Steels—TRI-TEN, COR-TEN, and MAN-TEN—write for a copy of *"Design Manual for High Strength Steels,"* United States Steel, 525 William Penn Place, Pittsburgh 30, Pa.

USS, COR-TEN, MAN-TEN and TRI-TEN are registered trademarks of United States Steel.



Fisher Memorial Bridge, Lawrence, Kansas
Owner—Kansas Turnpike Authority
Designer—Howard, Needles, Tammen & Bergendoff
Fabricator—Kansas City Structural Steel Co.
Erector—John F. Beasley Construction Co.

USS United States Steel

CE's Construction Forecast



Scraps & Shavings

LAST MONTH in this column, we suggested that it might be to the advantage of the client, the general public, and the consulting engineer if state registration acts were amended to require all engineers offering their services to the public to carry errors and omissions insurance.

The distasteful aspects of mandatory insurance are obvious. No one, particularly a consulting engineer, wants to be forced to do anything. In a sense this would involve more government control, and no one thinks well of that. The question is, would the good outweigh the bad if this suggestion were adopted. Would the reduction of "free engineering" and the elimination of many of the sundowners and kitchen sink engineers be worth it?

We are inclined to think it would. Mandatory insurance also would protect the public against errors of the dangerously stupid engineer, and it would protect other engineers against financial disaster following an honest mistake.

It is strictly on the basis of the protection afforded the public that legislation of this type would have to be sought. Legislatures would not be the least interested in the beneficial side-effects for engineers in private practice. It is likely, however, that legislatures would quickly see that mandatory errors and omissions insurance for engineers offering their services to the public would protect the public against dangerously incompetent practitioners.

Then, there is the problem of protecting the client against the safe but stupid engineer. This is the engineer who overdesigns so thoroughly that his projects are safe but cost many times more than they should.

This is not a matter for legislation. No law can quicken the mind of a moron. This must be handled in another way.

In certain European countries (Sweden, for example) an approach to the solution has been found. The associations of consulting engineers require that an engineer put up bond when he becomes a member. This bond stands as a guarantee of intelligent engineering work and ethical practices. If a member undertakes a project and completes it in an unsatisfactory manner, the client can bring his dissatisfaction to the attention of a board of association members. Both the client and engineer are called upon to explain their positions, and a decision is reached. If the engineer really has done a job so disgraceful that it is clearly below that to be expected from any member, he is required to pay the client. Unprofessional practice, such as the taking of kickbacks from equipment manufacturers or contractors in return for specifying particular equipment or overlooking poor construction work also would call for forfeiture of bond if the charges were proved.

In actual practice there have been few if any occasions for bringing members of the European associations before the boards. The fact that a bond is required is merely a guarantee of professional competence of the members.

This bond requirement has its distasteful aspects. Good, solid engineers like to feel that their word and their reputation is enough. Bonds, they feel, are for contractors and the trades. The client must trust his engineer as a professional man.

That is all very well when we are talking about the reputable, competent, responsible consulting engineers, but we must all admit that there are some who do not come up to the high professional level they should. Today, there is no easy way for the client to tell the good from the bad. Must he get stuck once or twice before he finds the right firm of engineers?

He cannot rely on society or association membership as a guide. No engineering organization in this country conducts an examination of its own to determine either technical competence or ethical standards of its members. All have codes of ethics, but it is rare that any attempt is made to enforce them.

A bond might not be a bad idea. It would be the equivalent of the association saying, "We stand as a body behind the work of our members. Any member of ours is not only technically competent and ethically above reproach, but we hold his bond to back this up. If he should fail you, we will not only hear you but will award you damages if you prove your complaint."

There is probably no association of consulting engineers in this country yet ready to adopt this proposal. Certainly it would be wise to go slowly. But it is an idea worthy of discussion. ▲▲



CE's Construction Forecast

Design work on the drawing boards today indicates the level of business activity materials producers and equipment suppliers can expect in the months that are ahead.

CONSULTING ENGINEERS have more business on their books today than they did 3 months, six months, or a year ago. This encouraging business news came to light as a result of a spot survey of typical consulting engineer firms across the nation just made by CONSULTING ENGINEER.

The result of this survey, while important to consulting engineers – giving them a bench mark for business activity within the profession – is of even more importance to currently depressed producers of materials of construction and manufacturers of industrial equipment. Business on the engineer's board today will show up in purchase orders a few months from now.

Economic forecasters may vary in their opinions, but the level of engineering design work is a sound indicator of the nation's economic future, for engineers' drawings and specifications will turn into material orders on an established time schedule. Reliable indicators of this type, according to a prominent bank economist interviewed by CONSULTING ENGINEER, are what he and other financial forecasters have been looking for.

In making the survey CONSULTING ENGINEER sent the following telegram to forty engineering firms in 22 cities.

CURRENT BUSINESS CONDITIONS FOR CONSULTING ENGINEERS ARE A PREDICTION OF WHAT INDUSTRY CAN EXPECT A FEW MONTHS HENCE. YOUR SPECIFICATIONS PRECEDE INDUSTRIAL PRODUCTION AND SALES. TO HELP WITH BUSINESS SURVEY PLEASE WIRE STATEMENT TELLING HOW BUSINESS ON YOUR BOOKS COMPARES WITH 3 MONTHS, 6 MONTHS, AND YEAR AGO.

Thirty-four replies were received, the great majority of them showing business on the books to equal or exceed one year ago. A summary of the information reported is presented here.

Pasadena, Calif. (Mechanical, civil, electrical, structural firm)
BASED ON SPECIFICATIONS AUTHORIZED BUT NOT ADVERTISED, OUR BOOKS SHOW US BELOW ONE YEAR AGO BUT CONSIDERABLY ABOVE 6 MONTHS AND 3 MONTHS AGO.

Denver, Colo. (civil, structural firm)
BUSINESS TODAY EQUAL TO ONE YEAR AGO, 20 PERCENT ABOVE 6 MONTHS AGO, AND MORE THAN DOUBLE 3 MONTHS AGO.

Miami, Fla. (civil, mechanical, electrical, structural firm)
OUR BUSINESS SLIGHTLY BETTER THAN THREE MONTHS AGO, NOT AS GOOD AS 6 MONTHS AGO, BUT BETTER THAN YEAR AGO. BECAUSE OF OUR DIVERSITY WE EXPECT EVEN BETTER CONDITIONS AND ARE STILL HIRING. WE ARE NOW WORKING NOT ONLY IN U. S. BUT IN 14 FOREIGN COUNTRIES.

Atlanta, Ga. (mechanical)
NO CHANGE OVER 6 MONTHS AND YEAR AGO, BUT 30 PERCENT ABOVE 3 MONTHS AGO. SIX MILLION DOLLARS NOW ON BOOKS FOR RELEASE WITHIN NEXT THREE MONTHS.

Chicago, Ill. (civil, structural firm)
OUR BACKLOG JUST A LITTLE BELOW 3, 6, AND 12 MONTHS AGO, BUT NOW CLOSING CONTRACTS IN WATER SUPPLY AND HIGHWAY FIELD THAT WILL PUT US AHEAD.

Rockford, Ill. (mechanical, electrical, civil, structural firm)
A 12 MONTH FORECAST FOR FEB. 1958 INDICATES 35 PERCENT INCREASE OVER 3 MONTHS AGO, 110 PERCENT OVER 6 MONTHS AGO, AND 250 PERCENT OVER YEAR AGO.

Belmond, Iowa (civil, structural firm)
OUR BUSINESS ACTIVITY TODAY 100 PERCENT ABOVE A YEAR AGO. WE ARE ALSO WELL ABOVE 3 MONTHS AGO AND 6 MONTHS AGO.

New Orleans, La. (civil firm)
OUR PRESENT BUSINESS IS SUBSTANTIALLY GREATER THAN A YEAR AGO, ABOUT THE SAME AS 3 MONTHS AGO, AND GREATER THAN 6 MONTHS AGO. OUR REVENUES FOR 1958 SHOULD BE GREATER THAN ANY YEAR SINCE 1942 AND MAY EVEN EXCEED THAT YEAR.

Minneapolis, Minn. (mechanical firm)
OUR BUSINESS NOW 160 PERCENT ABOVE 3 MONTHS AGO, 150 PERCENT ABOVE 6 MONTHS AGO, AND 130 PERCENT ABOVE ONE YEAR AGO.

Lansing, Mich. (civil engineer)
CURRENT BUSINESS BETTER THAN 3 MONTHS AGO, EQUAL TO 6 MONTHS AGO, BUT NOT AS GOOD AS YEAR AGO.

St. Louis, Mo. (mechanical, electrical, civil firm)
WE ARE EVEN WITH 6 MONTHS AND YEAR AGO AND BETTER THAN 3 MONTHS AGO.

(mechanical, electrical, civil, structural, chemical firm)
BUSINESS IS APPROXIMATELY 75 PERCENT OF 6 MONTHS AGO AND ABOUT EQUAL TO ONE YEAR AGO.

Albuquerque, N. M. (mechanical, civil, structural)
BUSINESS ON MY BOOKS IS ABOUT TWICE THAT OF LAST NOVEMBER, ABOUT SAME AS LAST AUGUST, AND A LITTLE BETTER THAN LAST FEBRUARY.

New York, N. Y. (mechanical, electrical firm)
VOLUME OF ORDERS OUTSTANDING 55 PERCENT GREATER THAN ONE YEAR AGO AND 30 PERCENT GREATER THAN 6 MONTHS AGO. DO NOT HAVE RECORD ON 3 MONTHS AGO.

(mechanical, electrical firm)
APPEARS THAT WE WILL HAVE ABOUT 10 PERCENT MORE BUSINESS THAN IN 1957.

(mechanical, electrical, civil, structural firm)
COMPARISON OF BUSINESS WITH ONE YEAR AGO IS AS FOLLOWS: 6 MONTHS AGO 90 PERCENT, 3 MONTHS AGO 50 PERCENT, AT PRESENT 40 PERCENT.

Syracuse, N. Y. (mechanical, electrical firm)
ASSUMING FEB 1, 1957 EQUAL TO 100 PERCENT, THEN AUGUST 1957 130 PERCENT, NOVEMBER 1957 100 PERCENT, FEBRUARY 1958 80 PERCENT.

Fargo, N. D. (electrical, civil, mechanical firm)
OUR BUSINESS IS EQUALLY AS GOOD AS IT WAS A YEAR AGO.

Cincinnati, Ohio (mechanical, electrical firm)
PRESENT WORK ON BOARDS INDICATES INCREASED VOLUME OVER LAST THREE MONTHS BY FIVE PERCENT OVER SIX MONTHS AGO BY TEN PERCENT OVER YEAR AGO BY 15 PERCENT.

Dayton, Ohio (mechanical, electrical firm)
BUSINESS COMPARED TO YEAR AGO DOWN. SOME IMPROVEMENT OVER 3 MONTHS AND 6 MONTHS AGO.

Oklahoma City, Okla. (electrical firm)
NEW PROJECTS GOING ON BOARDS STARTED DECLINE IN NUMBER AND SIZE LAST SPRING. DOWNWARD TREND CONTINUED THROUGH FALL BEFORE REVERSING. PROJECTS NOW IN DESIGN EQUAL TO YEAR AGO. NET RESULT IS CURRENT LULL IN CONSTRUCTION STARTS WHICH WILL CONTINUE UNTIL LATE SPRING WHEN PRESENT DESIGNS BEGIN COMING OFF OF BOARDS.

Portland, Ore. (civil firm)
OUR BACKLOG INDICATES AS GREAT A VOLUME AS 1957 BUT TENDING TO SLIGHTLY GREATER PERCENTAGE OF PUBLIC WORKS.

(mechanical firm)
WE ESTIMATE CURRENT DESIGN LOAD IN OUR OFFICE AT 20 PERCENT AHEAD OF YEAR AGO, 40 PERCENT AHEAD OF SIX MONTHS AGO AND 35 PERCENT AHEAD OF 3 MONTHS AGO.

Corvallis, Ore. (civil, mechanical, electrical, structural firm)
OUR BUSINESS 20 PERCENT MORE THAN 3 MONTHS AGO, 25 PERCENT MORE THAN 6 MONTHS AGO, 20 PERCENT MORE THAN ONE YEAR AGO.

Dallas, Texas (mechanical firm)
PRESENT WORK LOAD EQUALS 3 MONTHS, 6 MONTHS, AND A YEAR AGO. BOOKINGS FOR FUTURE WORK TO START 3 TO 6 MONTHS FROM NOW ARE OFF 25 TO 50 PERCENT.

(civil firm)
OUR BUSINESS IS HOLDING STEADY. STILL FIGHTING DELIVERY DEADLINES.

Salt Lake City, Utah (mechanical, civil, structural firm)
BUSINESS NOW ON BOOKS IS EVEN WITH 3 MONTHS AGO, 20 PERCENT OVER 6 MONTHS AGO, AND 20 PERCENT OVER ONE YEAR AGO.



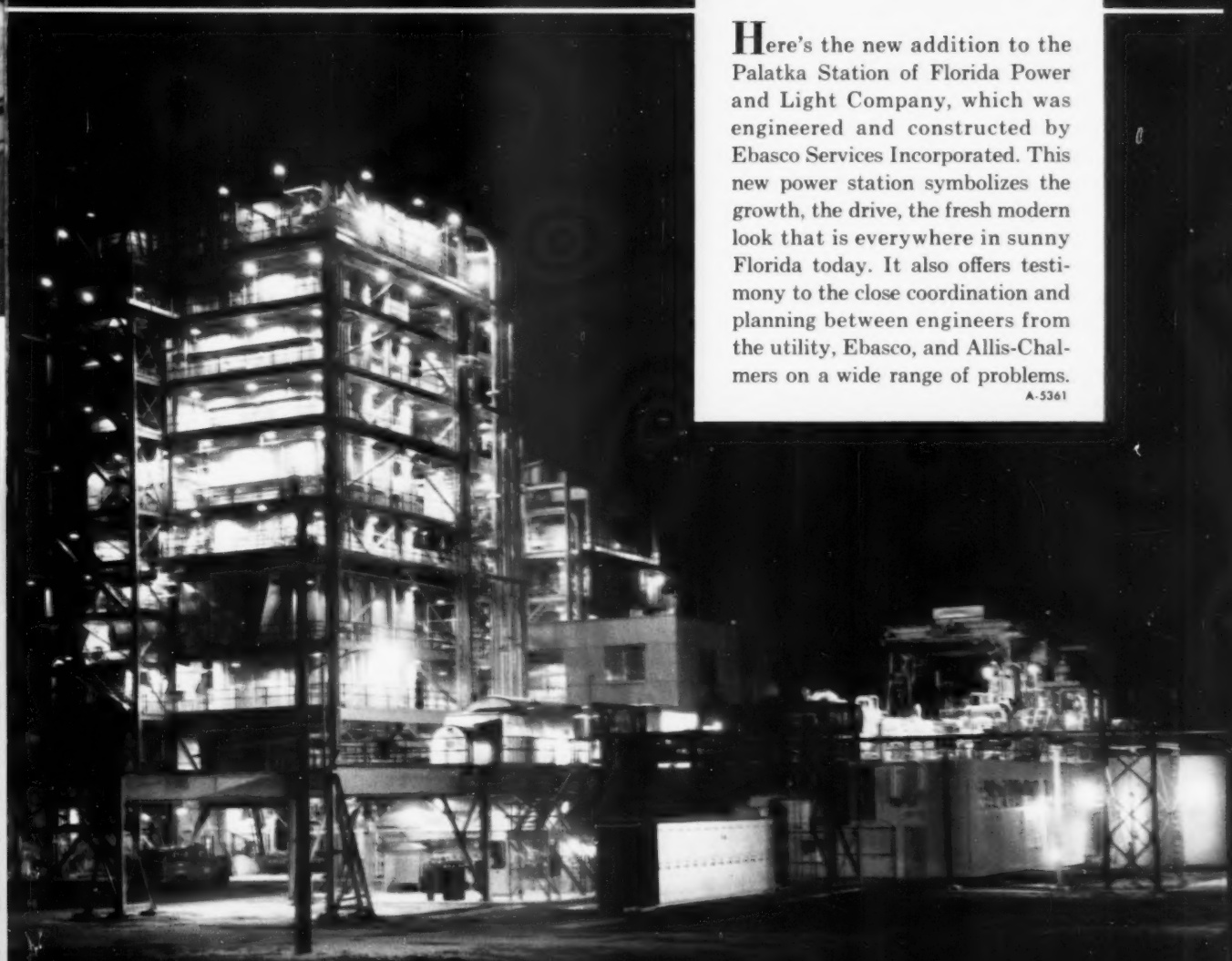
Outdoor Station

features

Wide Range of Allis-Chalmers Equipment

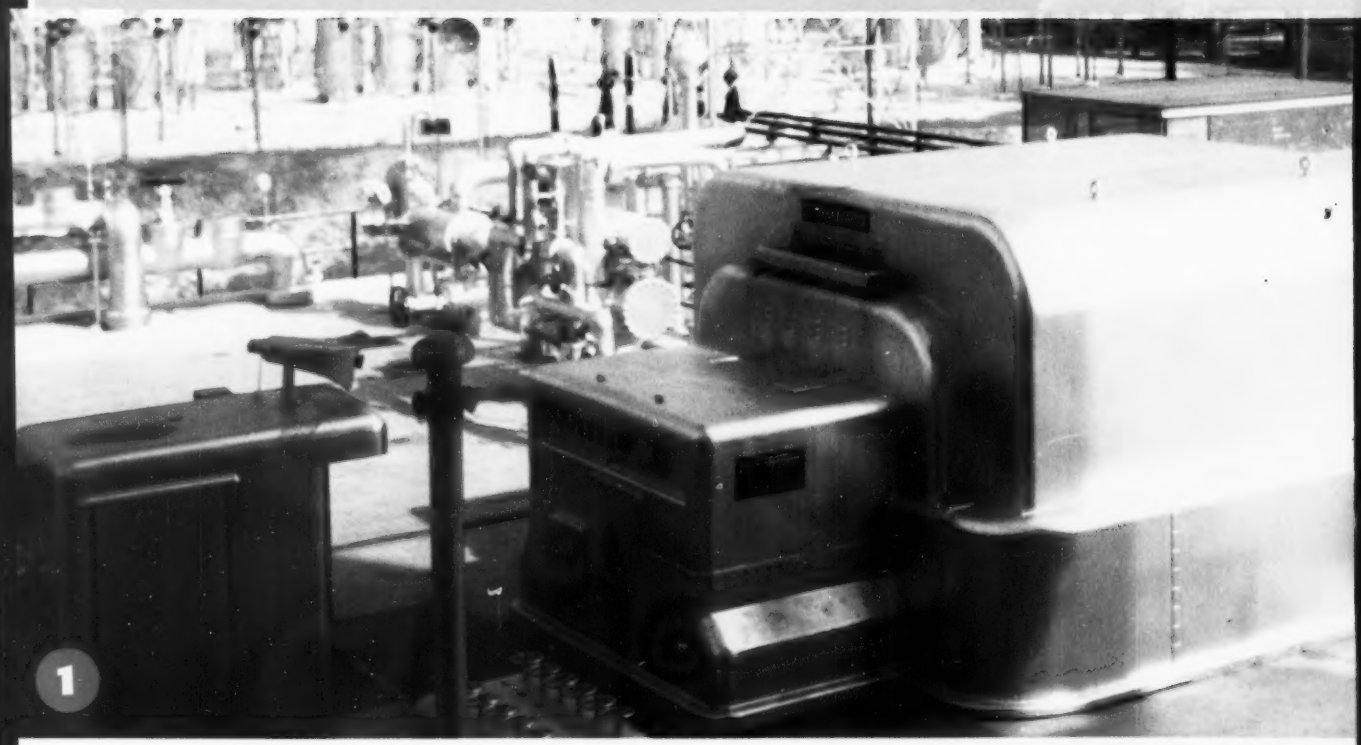
Here's the new addition to the Palatka Station of Florida Power and Light Company, which was engineered and constructed by Ebasco Services Incorporated. This new power station symbolizes the growth, the drive, the fresh modern look that is everywhere in sunny Florida today. It also offers testimony to the close coordination and planning between engineers from the utility, Ebasco, and Allis-Chalmers on a wide range of problems.

A-5361

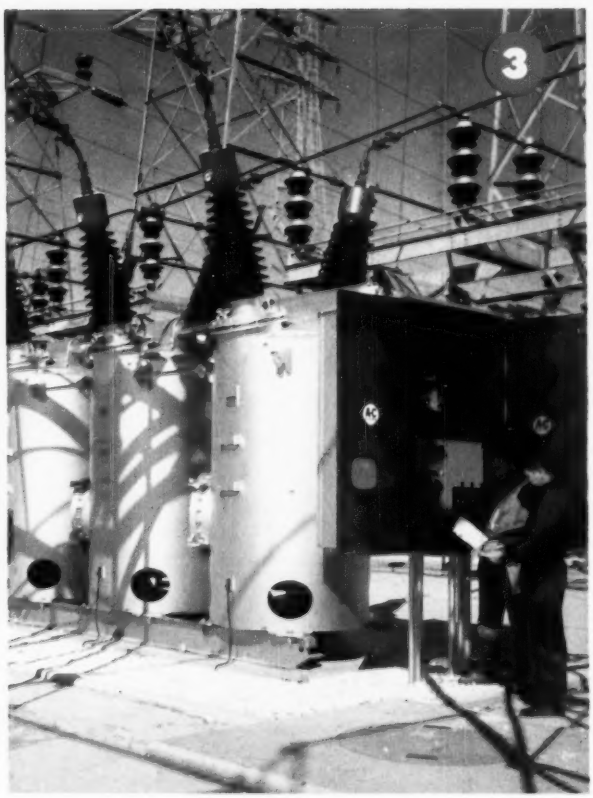


Palatka Station

ALLIS-CHALMERS

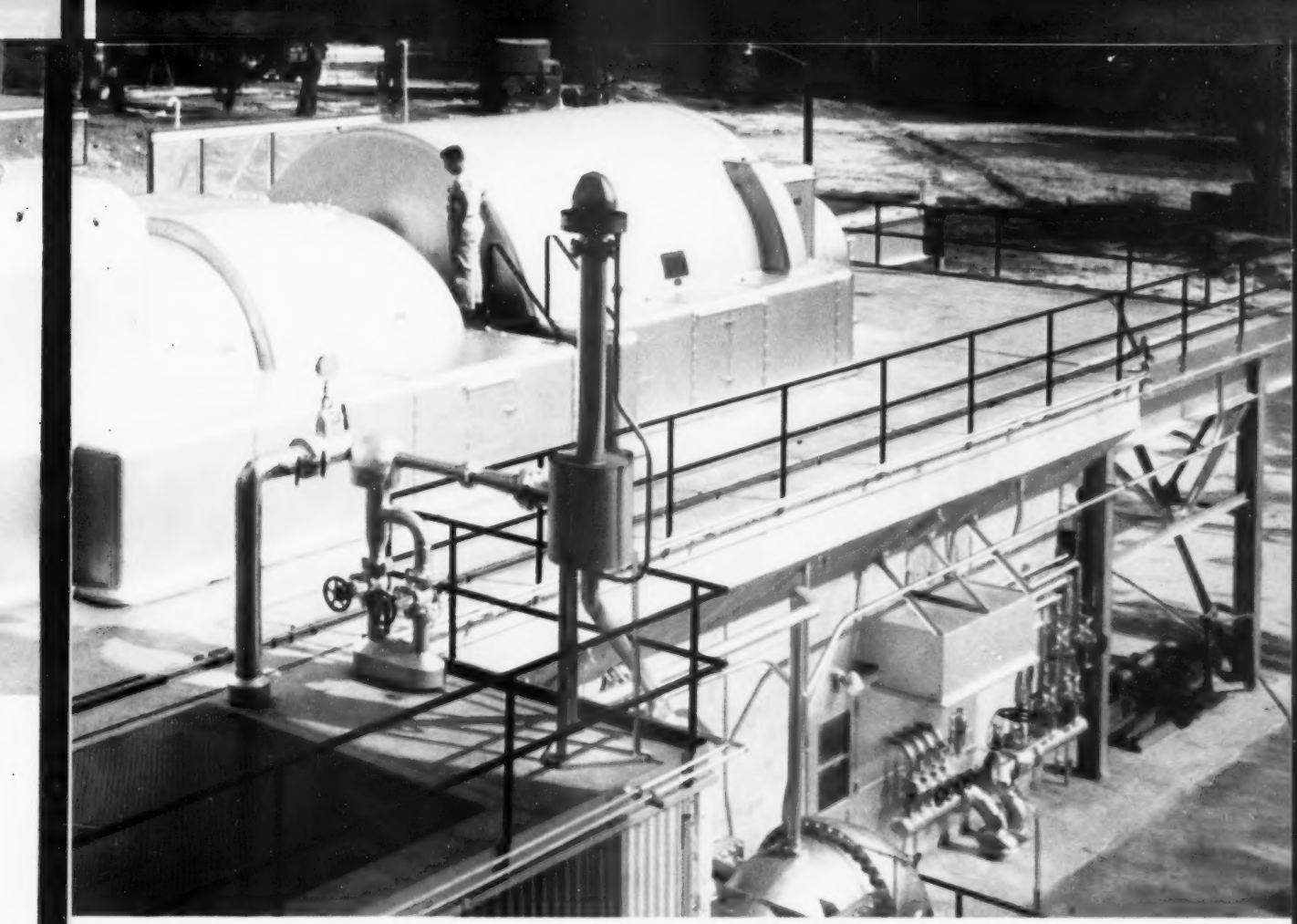






A-C ALLIS-



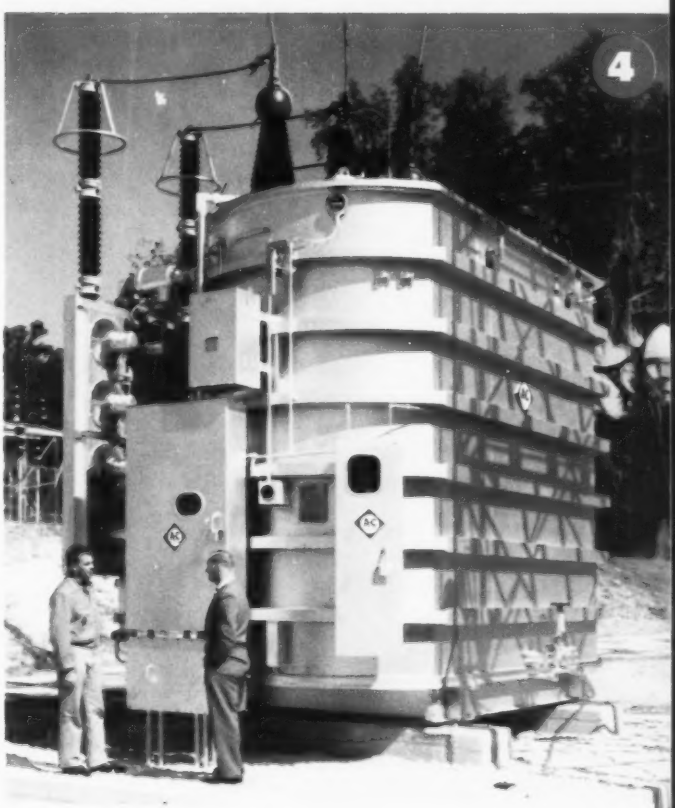


1. At the heart of things is the 62,500-kw outdoor steam turbine generator unit, featuring permanent side-crossunders between high and low pressure tandem turbines, steam valves below deck, supercharged generator with direct hydrogen-cooling of rotor copper, and commutatorless excitation system with inherent rapid-response voltage regulation. Units to 220,000 kw are in production by Allis-Chalmers for outdoor stations.

2. Switchgear — Allis-Chalmers 2400-volt and 480-volt outdoor weatherproof switchgear controls major station auxiliaries.

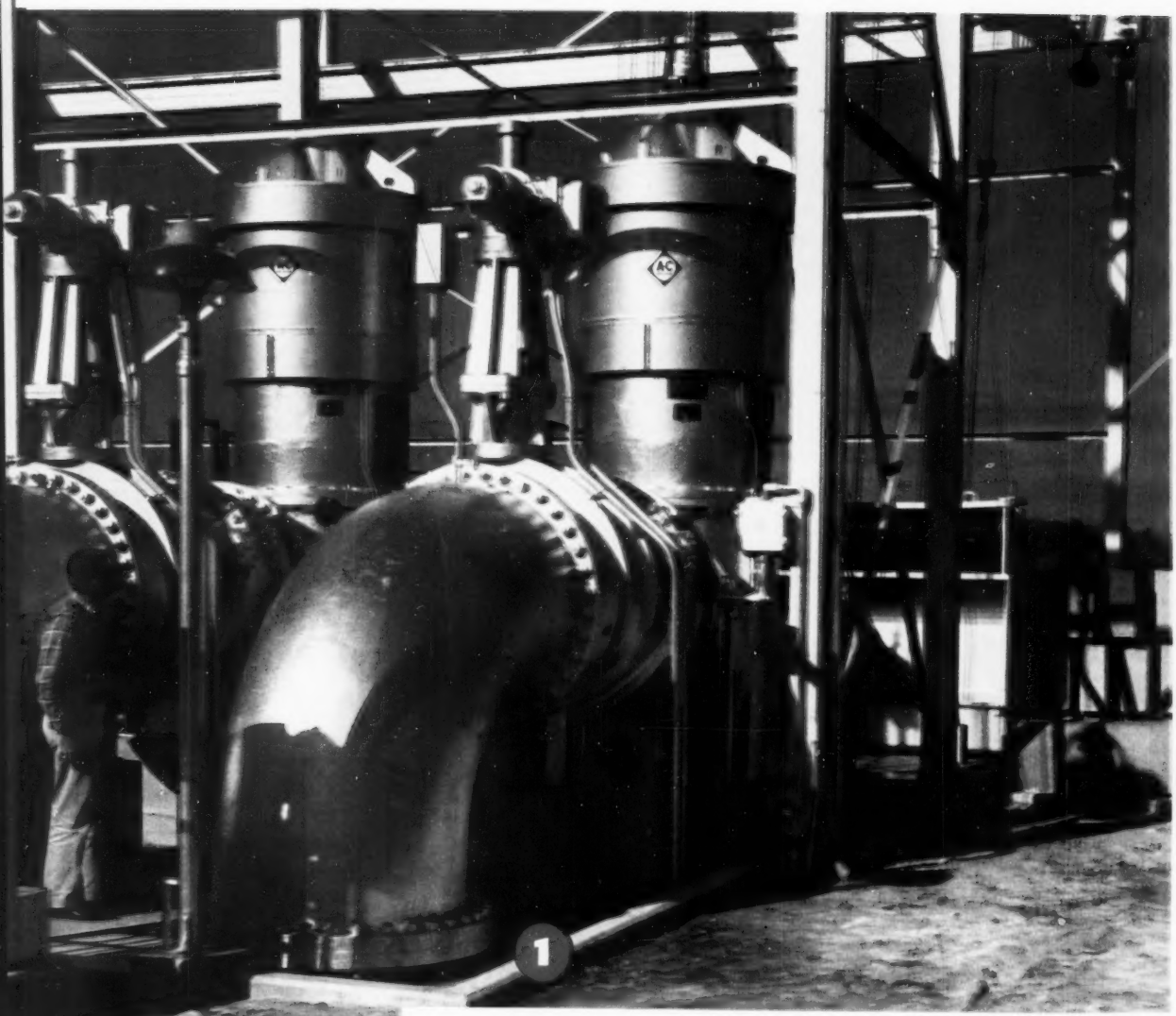
3. Circuit Breakers — *Pneu-Draulic* operators and mechanically trip-free operation are features of three 115-kv Allis-Chalmers circuit breakers.

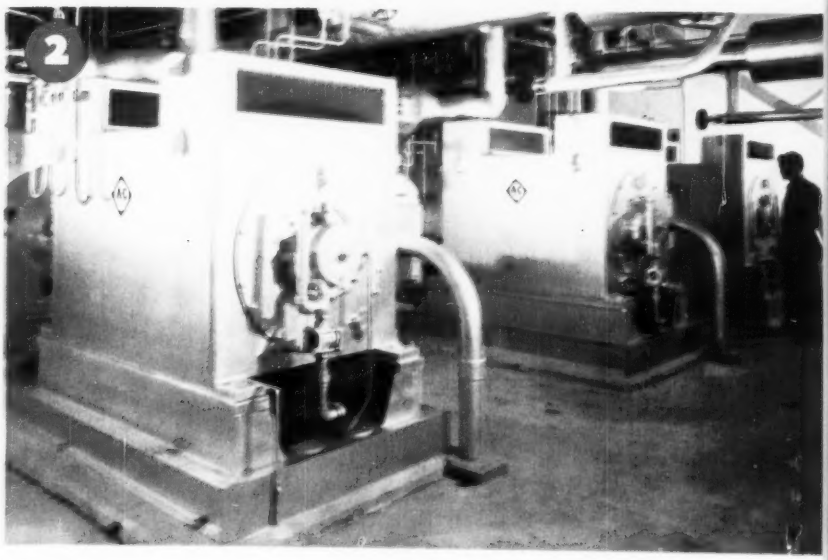
4. Transformers — This 85,000-kva forced oil cooled power transformer is for main step-up service to the 115-kv lines.



Pneu-Draulic is an Allis-Chalmers trademark.

CHALMERS



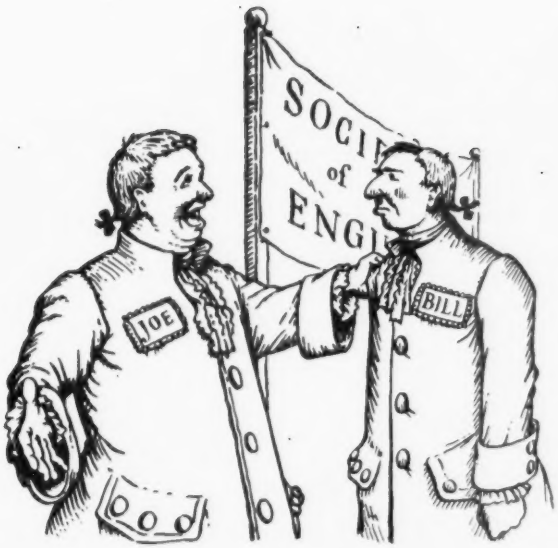


1. **Pumps-Motors** — Shown above are two vertical weather-protected motor-pump units furnished by Allis-Chalmers.

2. **Control Centers-Motors** — For boiler feed pumps; induced and forced draft fans were furnished by Allis-Chalmers.

For the complete story on *all* the products Allis-Chalmers builds for electric power generation, distribution and utilization, call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS



Heard Around Headquarters

STAFF

IT'S GETTING so an organization can't even choose its enemies anymore.

The National Society of Professional Engineers long has held the position that unions and professionalism are incompatible. During recent hearings in which the court ruled that the National Labor Relations Board could not merge engineers and technicians into a single union against the wishes of the engineers, NSPE was among the friends of the court who appeared against the NLRB. So was the Engineers & Scientists of America.

More recently, NSPE came out against President Eisenhower's proposal for 10,000 undergraduate scholarships annually for the next four years. So did ESA.

NSPE explained that the emphasis on science and engineering should be in quality rather than quantity. ESA warned against overemphasis of science at the expense of other intellectual disciplines.

THE ENGINEERS JOINT COUNCIL is investigating the possibilities of forming a Federation of Engineering Societies among nations of the Pacific and Far East. The Federation, tentatively, would include the United Technological Organization (Philippines), the Institution of Engineers (India), the Japanese Federation of Engineering Societies, the Institute of Engineers (Pakistan), the Institution of Engineers (Australia), the Council of New Zeeland Institution of Engineers, and the Association of Engineers (Burma).

To date, the Philippine and Indian groups are in favor of the proposal.

The Institute of Pakistan will consider the matter at the next board meeting.

The Institution of Engineers, Australia, also will discuss the Federation at the next meeting. However, the Australians pointed out that they previously had discussed the desirability of a South-East Asian Conference, which they inferred would serve their needs.

The New Zeeland Institution of Engineers emphasized that, by overseas standards, they are a small organization with limited resources, and hence are obligated to exercise considerable caution in entering into commitments involving financial obligations. However, the Institution asked to be kept informed of developments.

THE PERENNIAL tug-of-war over corporate practice of engineering is in full bloom again in New York State. A number of bills affecting corporate practice already have been introduced for the current legislative session, with indications that there may be more to come.

The New York Association of Consulting Engineers voted unanimously at a recent meeting to go on record in favor of the New York State Society of Professional Engineers survey findings. (The survey was more than two to one against corporate practice.) Letters regarding the Association's stand against corporate practice are being sent by the Association legislation chairman, James P. O'Donnell, to all senators and assemblymen.

Senator Wheeler Milmoe, who has been introducing bills favorable to corporate practice for the past five years, has submitted another bill (with the blessing of the Committee on Engineering Laws) to the New York State Senate.

Senator Milmoe's bill asks that: "There shall be no discrimination by implication, omission, or direction as to the form of business organization, individual, partnership, corporation, or other, permitted to practice professional engineering provided the persons in responsible charge of the professional engineering practice of such business organization

are legally licensed professional engineers."

Senator Thomas J. Mackell has introduced another bill, which would virtually eliminate corporate practice. Under this bill, persons or existing corporations practicing engineering or land surveying in New York State would have to register biennially. However, licenses would not be granted to corporations, "nor shall any corporation hereafter formed use or assume a name involving the word 'engineers' or 'engineering' or any modification or derivative of such terms except a nonprofit membership corporation composed exclusively of professional engineers."

Corporations now operating under the New York "grandfather clause" (registered prior to 1935) would be allowed to continue operation if the chief executive officer is a licensed professional engineer. These corporations cannot change their names or sell their franchises, without the approval of the State.

THE AMERICAN Thrift Assembly, which is carrying on the fight for the Jenkins-Keogh bill needs money. In the battle for the bill, the engineer has been given equal billing with doctors, lawyers, dentists, accountants, and other professions. Yet the financial burden has been carried largely by lawyers, doctors, and accountants.

The American Bar Association and the American Medical Association each have contributed more than $15,000 to the fund. Accountants have pledged $12,000. The National Society of Professional Engineers has given $1500, and individual consultants and consulting engineering firms have contributed an additional $2300.

The Jenkins-Keogh bill would permit self-employed persons to set aside a portion of their income for retirement purposes on a tax-deferred basis. An annual amount up to 10 percent (but not to exceed $5000) from a consultant's annual income could be put in a private restricted retirement fund or paid as premiums to purchase an insurance policy with retirement features. If the consultant is 50 years old or more before the effective date of the bill, he would be allowed an additional deduction beyond these limits.

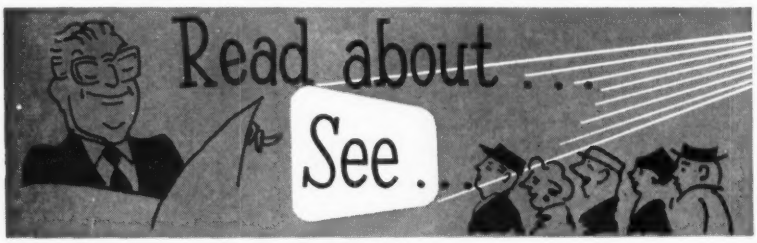
This retirement fund would not be taxed until after the consultant had reached retirement age and was receiving payments. He then would be in a lower tax bracket.

NSPE would be glad to forward any contributions.

THE TEXAS Attorney General has ruled that a manufacturer cannot use the term "engineering" in his corporate title.

In the Texas case, involving Vaden Engineering Company, the Attorney General ruled that the firm was in violation of the Texas Engineering Registration Act.

"We are of the opinion that the word 'engineering' in the title of the Vaden Engineering Company



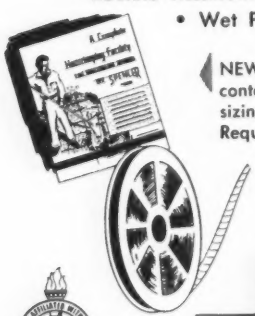
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SEE for yourself why this easily installed, inexpensive, *completely practical* cleaning system is proving so popular. There's just nothing like it for schools, hospitals, other predominately bare floor buildings. VACUSLOT capitalizes on the ease and speed of dry mopping, yet assures the dust-free, germ-free sanitation that only *vacuum* can provide.

The SPENCER VACUSLOT System simplifies *all* cleaning tasks, including.

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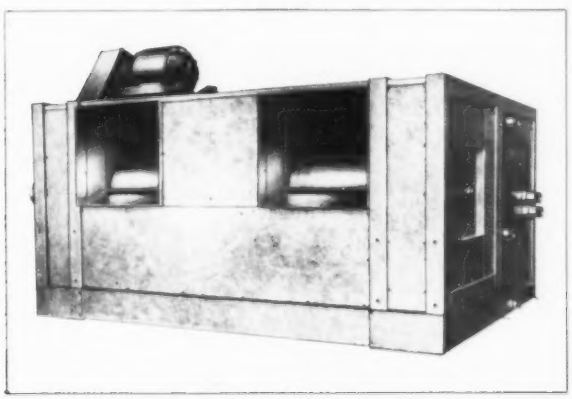
NEW bulletin describes VACUSLOT System . . . contains "in use" photos, schematic drawings, sizing information and typical specifications. Request Bulletin 153C.

NEW 20 minute color movie shows typical Spencer Vacuum Systems in operation. Write requesting showing at your convenience.

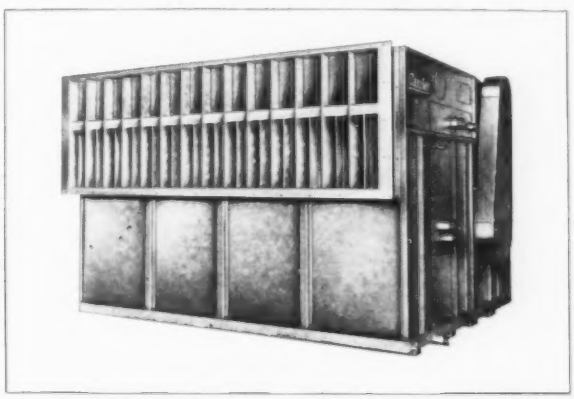
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Today, tomorrow or the day after, someone in your office will be face to face with the time-consuming problem of locating and selecting the right fan-coil unit for an air conditioning system. Now Carrier cuts hours off the job with these two new central station air conditioners. They're so compact they go places where others won't. They make piping layouts a cinch. Connections are all on one side or the other. Truly horizontal or truly vertical air discharge solves location headaches. Centrifugal fans develop up to four inches static pressure to handle air distribution at higher velocities. Larger sizes often make one unit do the work of two. Cooling and heating capacity requirements can be closely matched. Equipment selection is hours quicker from only one catalog by either the Entering Wet Bulb or the Apparatus Dewpoint method. No basic data calculations required. For your copy of the 72-page catalog that provides complete, detailed information, phone the nearest Carrier office. Or write Carrier Corporation, Syracuse, N. Y.



39AC SYSTEM WEATHERMAKERS for conventional central station applications. Building block construction for easy field handling. For use with direct expansion or chilled water cooling systems; steam or hot water heating systems. In eight sizes, from 3000 to 41,000 cfm and air velocities from 300 to 700 fpm.



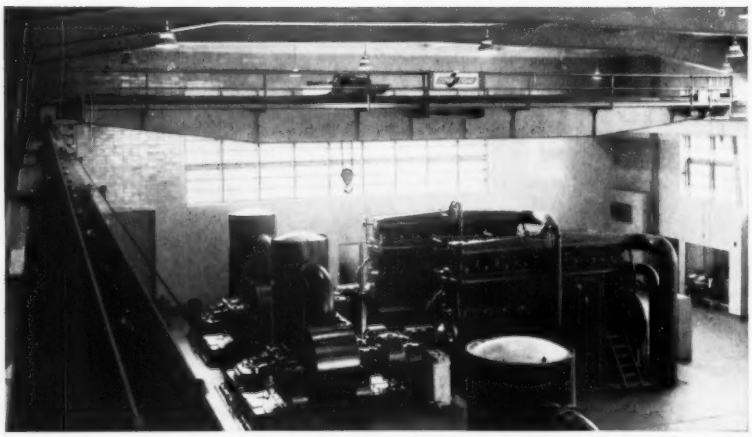
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CONCO "CRB" OVERHEAD ELECTRIC TRAVELING CRANE installed in municipal sewage disposal plant.

A feature of this Conco "CR" series crane is a worm and gear mechanical load brake which provides maximum safety, lower first cost, and the elimination of any adjustment or service needs. The brake offers a virtually limitless service life. It has only 2 moving parts. Conco "CR" cranes are one of many types custom-built for all classes of service. To engineers Conco offers two important facilities: A plant flexibility that permits true custom-building at a practical cost. And, a staff qualified by 50 years experience to provide such design assistance as you may request. May we submit specification data, an estimate, or a proposal on your next crane requirement? Write for Bulletin 3000A.

APPLICATION NOTE: Conco has engineered special spark-proof and explosion-proof cranes for installations such as Naval Ammunition Depots, U. S. Air Force Bases, the U. S. Atomic Energy Commission, and Thiokol.

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CONCO ENGINEERING WORKS

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See Our Catalog: Sweet's Industrial Construction File

clearly gives the impression that this organization is qualified to render engineering service. To convey such an impression by its name is in direct violation . . .," the ruling said.

The opinion was in response to the question: "Do the provisions of the Texas Engineering Registration Act apply to the owners of a corporation which uses the term 'Engineering' in its corporate title, where the corporation is engaged in the manufacturing business and does not hold itself out to the public as being available to render engineering services?"

THE LOUISIANA Engineering Society, formed in 1898, became a member of the National Society of Professional Engineers at the NSPE general spring meeting in Lansing, Mich., last month. The Louisiana group became the 46th NSPE chapter.

NEXT FALL, NSPE will — for the first time — provide free subscriptions to its *American Engineer* for engineering students. Copies will be sent only during school terms.

Providing the NSPE publication, in an attempt to acquaint the students with the necessity for registration and with the professional aspects of engineering, is a part of the Engineers Industrial Committee's education program.

Since December, the committee has been sending increasing amounts of literature to school libraries. Copies of *Criteria for Professional Employment of Engineers* also have been provided college seniors through their deans of engineering.

For high school students, NSPE is distributing vocational literature. Requests for these booklets has doubled this year.

EDUCATION was one of the primary topics at the Sputnik-conscious AIEE winter general meeting in New York City.

Thomas J. Watson Jr., IBM president, pointed out that Russia uses capitalistic concepts to moti-

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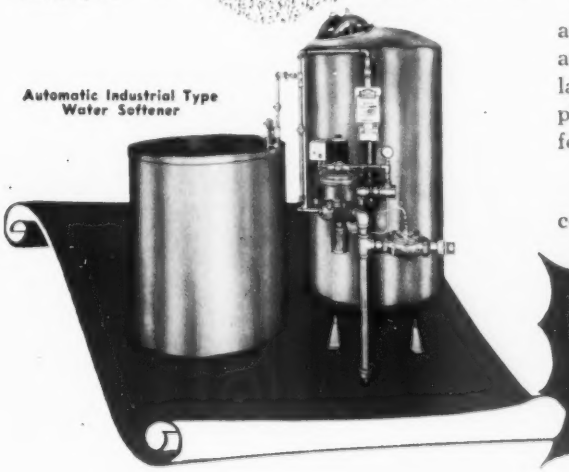
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vate their teachers, while in the United States, "we have almost socialized the teaching profession." Watson said that in Russia, a professor is an economic giant earning eight times as much as the average Soviet citizen in a manufacturing plant. In the U.S., college professors on the average receive approximately one and one-half times as much as our industrial hourly workers.

"If we were just to bring the purchasing power of our teachers back to prewar levels, it would be necessary to increase their salaries by at least 75 percent. And, clearly, this is not enough if we are to attract the best manpower into the teaching ranks."

P. A. Albetti and G. F. Lincks, who attended the International Electro-Technical Commission, visited Russia, and studied Russian technology, pointed out that:

¶ Russia is instilling an understanding and respect for the scientific approach in all its people by early teaching of science.

¶ Russia concentrates heavily on training and use of engineers in the planned growth of the country.

¶ Russian engineering education provides a basic foundation in the first two or three years, then becomes highly specialized in the fifth year (of college).

¶ Soviet educational institutes and universities are graduating 60,000 engineers annually, compared with our 25,000 to 30,000.

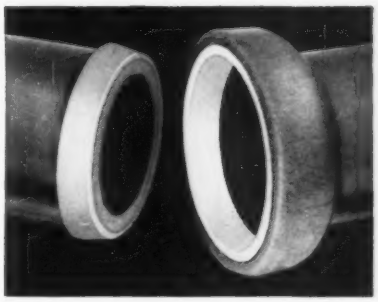
¶ Engineers in Russia follow closely new developments in foreign countries, especially the United States and Western Europe, are well acquainted with two or three languages, and have extensive technical translation and abstracting facilities at their disposal.

"Correspondingly," the report concluded, "American engineers would gain by following more closely developments in other countries, including the USSR."

From India came a report that the government has forged ahead in technical education. Michel G. Malti, professor of electrical engineering at Cornell University,

lower installation costs FIVE WAYS with longer, stronger AMVIT Clay Pipe

Outstanding Mechanical Joint of Plasticized Resins of Polyvinyl-Chloride Gives Lower Cost-In-Place



A million dollar expansion program to increase production facilities for Amvit* was completed earlier this year. New horizontal extrusion machines now manufacture pipe in over four feet lengths.

Longer lengths lower installation costs, reduce the number of joints, lessen the number of pipe sections to be handled. *Here's how you can save on installation with Amvit:*

1 SAVES LABOR



No other materials such as caulking, joint compounds, hot pots or ladles are needed to make the Amvit Joint. The joint is on the pipe delivered to the job ready for use. Nothing else is needed. Just push the pipe together and the joint is complete.

2 IMMEDIATE BACKFILLING



As soon as the joint is made, backfilling can start. No need to wait for unnecessary delays caused by bad trench conditions, high-water table, unstable ground or running sand. Barricades can be removed and streets opened days sooner.

3 QUICK TESTING

No need to wait days to see if a line has passed test. A look at the completed joint will tell. Thus, engineers can inspect and accept the line allowing the contractor to receive payment quicker.

4 PERMITS DEFLECTION, ABSORBS SHOCKS

Amvit is made from a plastic which has many characteristics similar to rubber. It is pliable, permitting deflection without leakage. It is resilient, can absorb shock and vibration. This allows for settlement of pipe in poor ground conditions after backfilling.

5 COMPLETE FITTINGS

Amvit is furnished on all standard fittings, as well as pipe. This will permit a uniformly tight line from house wall to treatment plant.





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For more information on how Amvit can help cut your sewer project costs, write or call American Vitrified Products Company, National City Bank Building, Cleveland, Ohio, or our office nearest you.

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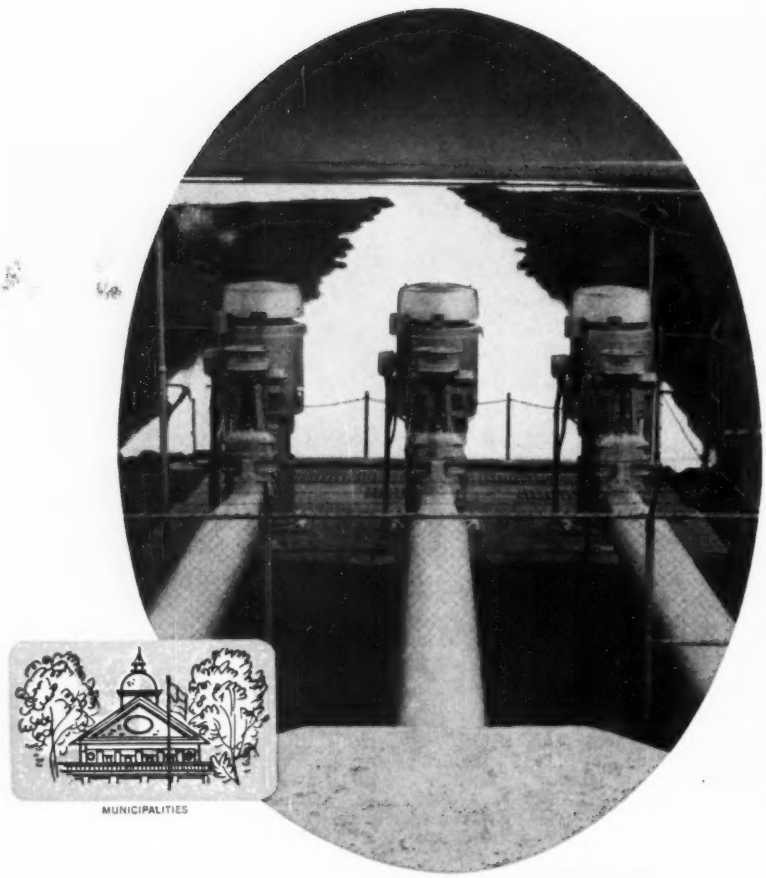
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who spent two years teaching in India, said students in India are highly intelligent because they are selected on the basis of an entrance examination. Although Indian universities offer courses not generally offered by American universities (diploma and refresher courses), faculties of the Indian schools need improvement.

The cost of technical education in India is low ($30 annually) but still is expensive when attuned to the income of Indian parents.

At Technical Sessions . . . .

Power distribution systems for large schools were compared to distribution systems required for commercial buildings and industrial plants.

Special recommendations submitted to the power systems symposium were that:

¶ Equipment energized at voltages in excess of 300 volts to ground must be protected from children.

¶ High voltage distribution systems must be designed for safe operation and maintenance by school personnel who have little or no training in the handling of high voltage equipment.

¶ All high voltage equipment must be identified with complete operating and maintenance instructions so outside personnel normally called upon in case of trouble can make repairs quickly.

In his report to the symposium, D. T. Michael, of the Cincinnati Gas & Electric Co., concluded that AIEE local sections should accept the civic responsibility of inspecting their local school buildings and be sure proper safety and operating practices are complied with.

D. H. Smith, of Bell Telephone Laboratories Inc., told the electrical engineers that current cost reductions can make the solar power plant competitive with the air-depolarized battery. Tests have demonstrated the technical feasibility for a power plant capable of furnishing one watt.

Smith added that the principal expenses in a solar plant are the photodiodes and storage battery. Photodiodes having higher effi-

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You select your community. You specify plant construction details or choose one of several plant "shells" now being readied for completion.

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Pennsylvania recently took major steps to create a new "tax climate" favorable to new and established industries. The following basic tax changes were enacted in 1957:

Manufacturers were exempted from capital stock and franchise taxes;

Machinery and equipment taxes were eliminated, state-wide;

Stock transfer tax was repealed;

Temporary 3% sales tax was made permanent;

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The absence of a state personal income tax, plus these new tax revisions, provide a major tax advantage to companies located in Pennsylvania.

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The Pennsylvania Department of Commerce, through its staff of engineers and economists, will "custom-tailor" complete plans for a new plant site to your specific requirements. Special reports and tabulations will be presented covering labor, markets, transportation, communities, raw materials, minerals, water, power, fuel, engineering services, research laboratory facilities, etc.

Industrial representatives are also available to you for personal inspection tours and consultations concerning your plant location needs. *All inquiries are confidential!*



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ciency than those used during the tests now are commercially available at about $2 per cell — a 10-to-1 price reduction in less than two years.

A NEW membership directory has been completed by the American Institute of Chemical Engineers. The directory is available, upon request, to members.

THE ENGINEERS Joint Council board has agreed that their vice presidents should be selected with the thought that they will be the probable successors to the president. However, it decided against a direct policy of succession.

Future vice presidents will coordinate committee activities and act as chairmen of the planning committee. Rotation among the various member societies will be a secondary consideration.

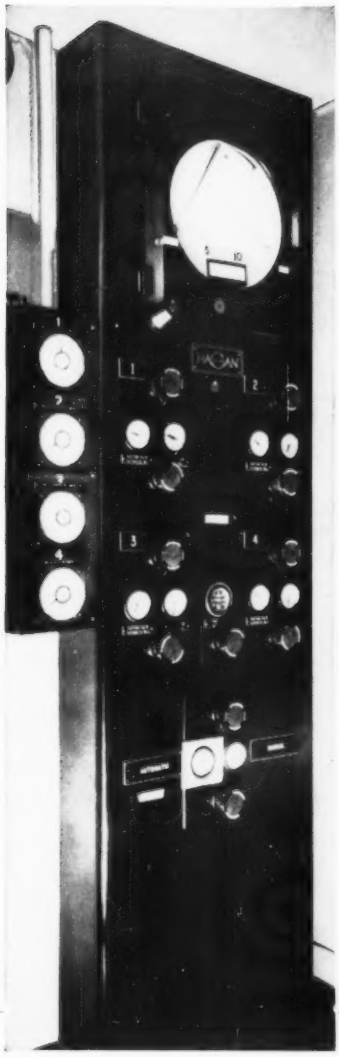
EJC also has adopted its first public relations policy. The public relations committee is to:

- Consider the general public as the prime benefactor of the work of individual engineers as well as the work of EJC, and thus put public knowledge of engineers and EJC first in its efforts.
- Realize that although it is a part of the general public, the engineering profession as represented by the constituent societies of EJC can and should receive regularly through its societies' journals, and directly, detailed reports of EJC activities and accomplishments.
- Keep constantly informed of the problems of engineers, as well as problems of the general public of which engineers might be of service, and report to the EJC board on potential public service areas.

In addition, a basic guide for participation in telecasts and broadcasts has been adopted.

EJC agreed that no exclusive rights to its name or its technical assistance will be given to any program, and EJC participation will be limited, generally, to institutional programs.

The public relations director and the EJC staff also were granted the



HAGAN CONTROL SPEEDS ANTIBIOTICS PRODUCTION—LOWERS COSTS

Precise compressor controls pay for themselves at Squibb plant

At the New Brunswick plant of E. R. Squibb and Sons, fermentation tanks containing the micro organisms which produce antibiotics depend on a constant supply of air. Any interruption increases the possibility of contamination, lowers production, and may involve complete loss of the batch.

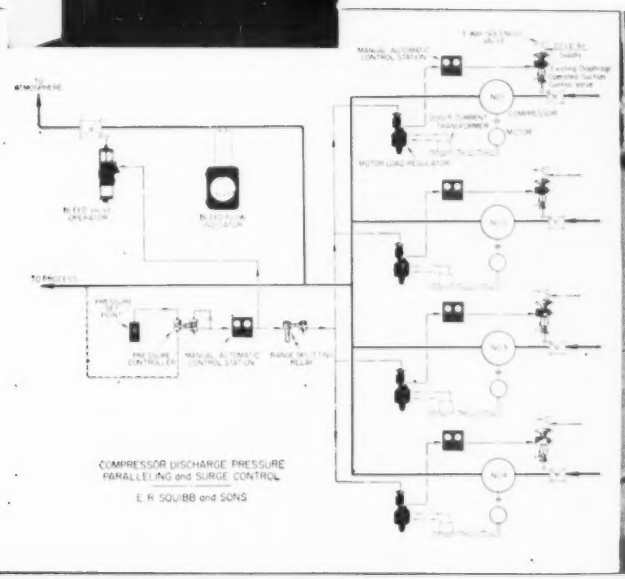
The manual controls on the four 12,000-cfm, 4-stage centrifugal compressors, used prior to the Hagan installation, made use of an elaborate alarm system and resulted in both overloading and surging of the compressors. At changeover, when a fermentation tank was added or removed from the line, excess air would be discharged into empty tanks to keep compressors from surging, and extra personnel were needed to handle valves and motor current controls.

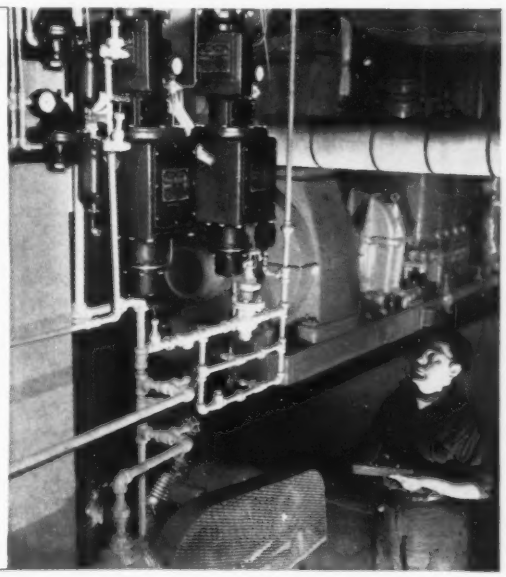
With the installation of the Hagan system, these problems disappeared. Both valves and motor current are now under automatic control, with the result that frequent starting and stopping of compressor motors has been curtailed, all tanks receive the proper air pressures, there is no need for extra operating personnel to handle changeover, and the compressor system as a whole is operating efficiently. The savings in personnel, in lower average power consumption and in higher production has more than paid for the system.

Hagan automatic controls for a great variety of processes are available as complete systems or as integrated components which may be linked together or made a part of existing controls. Hagan has pneumatic, hydraulic or electronic components which can be used in a variety of combinations. A Hagan engineer will be glad to work with you in solving your particular control problem. For more information, write or phone:

HAGAN CHEMICALS & CONTROLS, INC.

HAGAN BUILDING, PITTSBURGH 30, PENNSYLVANIA
DIVISIONS: CALGON COMPANY, HALL LABORATORIES
IN CANADA: HAGAN CORPORATION (CANADA) LIMITED, TORONTO

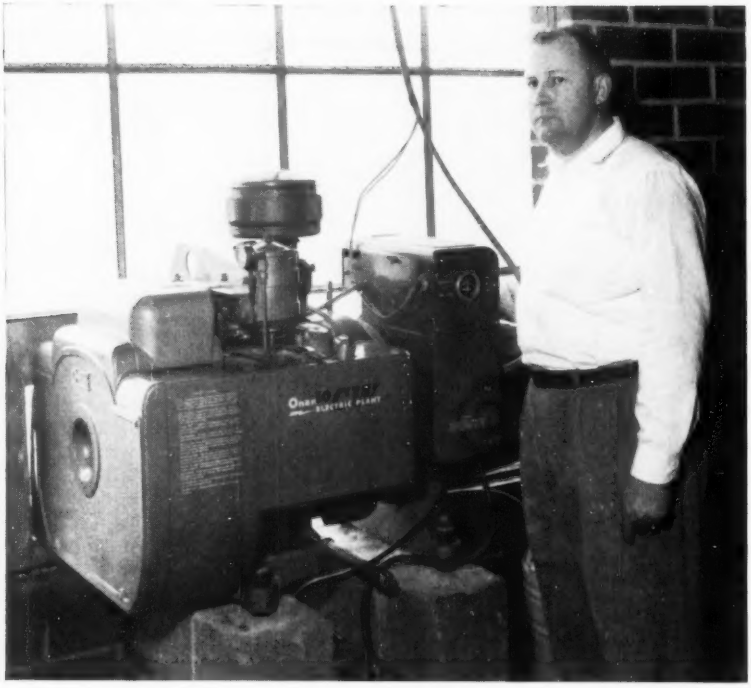




The heart of the system is the pressure controller which maintains process air pressure by varying compressor motor load between allowable limits, and by controlling the bleed valve opening when compressor load has been reduced to minimum.

Two of the motor load regulators which receive a signal from the pressure controller. They prevent overloading or unloading (surging). Write for specification sheet GE500, which describes the Hagan Alternating Current Controller's unusual features.

ELECTRIC PLANT
NEWS



Standby plant paid for itself four times in four months

"Couldn't operate without this protection", says C. G. Young of the Hiawassee Hatchery

Sleet, lightning, wind and snow . . . each took their turn at knocking out the high-line serving the Hiawassee (Georgia) Hatchery. Power was off for periods ranging from 2 to 7 hours. Each time, the Onan CW Standby Plant started automatically and took over the power load . . . operating all essential equipment *and preventing any loss whatsoever.*

Standby protection at lower cost

Onan air-cooled plants like the CW model shown here, cost substantially less than water-cooled units of similar capacity. Onan's exclusive Vacu-Flo cooling system permits using these lower-cost, air-cooled units where previously it would have been necessary to use water-cooled plants or to install elaborate ventilation equipment. Vacu-Flo models range from 1,000 to 10,000 watts . . . water-cooled from 10,000 to 75,000.



Automatic operation . . . *This Onan line transfer control starts the electric plant when power is interrupted and switches current to all essential hatchery equipment. Plant stops automatically when power is restored . . . protects hatching stock at all times.*

See Our Catalog in Sweet's or Write for Specifications.

D. W. ONAN & SONS INC.

2742A Univ. Ave. S.E., Minneapolis 14, Minnesota • PHONE: FE 2-1155

ELECTRIC PLANTS • AIR-COOLED ENGINES • GENERATORS • KAB KOOLER

"reasonable" power to act where a time limit precludes full public relations or executive committee action.

THE MAJOR medical and life insurance plan of the New York Association of Consulting Engineers now is in effect, administered by a board of trustees.

Serving on the board are Peter J. Reidy, Association president; John F. Hennessy Jr. and Matthew Hiller, vice-presidents; John K. M. Pryke, past president; and Sigmund Roos, member-at-large.

The group plan, from Connecticut General Life Insurance Co., has gained wide acceptance among Association members. Twenty-four firms have agreed to participate in the insurance program, with 11 other consulting firms planning to follow suit. Participating firms have 777 employees.

A typical firm, with 53 employees, has a rate of $1.24 per employee for the medical coverage. Dependents cost an additional $1.64 (for one) or $2.32 (more than one) per month. The firm pays all costs, a total of $134.52 per month.

The 53 employees in this typical firm have total life insurance coverage (under this plan) of $116,000. The amount each employee gets varies according to his income, with an average premium of 60 cents per $1000 coverage as a monthly rate.

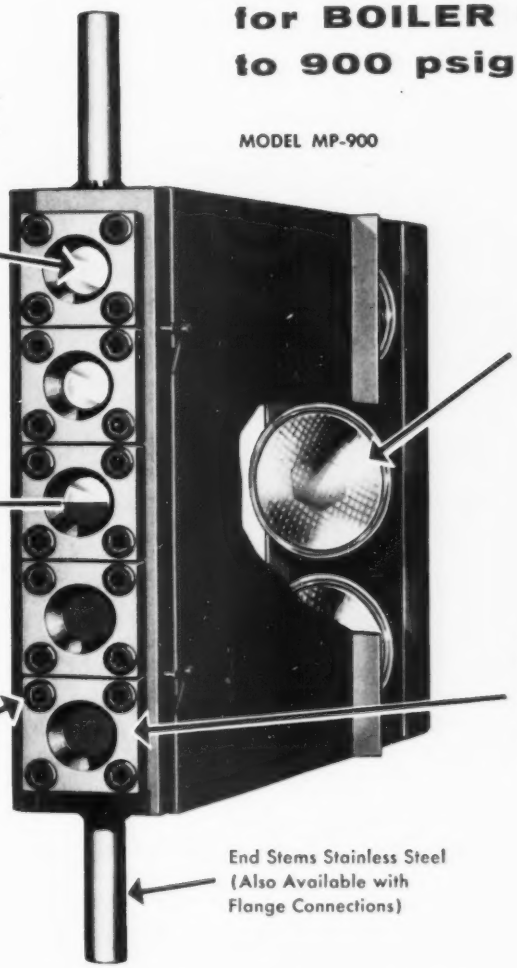
These employees already were covered by Blue Cross and Blue Shield. In order to explain the new medical and life insurance plan, the employer circulated a letter and also asked a representative of the insurance company to speak to the employees.

Association firms participating in the program tentatively have agreed that new employees will have a waiting period of three months before they will become eligible for the policies. If the employee quits his job but obtains a position with another Association member, the waiting period will be waived. ▲▲

Sure-Reading ...DIAMOND "Multi-Port" Bi-Color Gauge

for BOILER PRESSURES to 900 psig

MODEL MP-900



Ports Have Individual Round Glass, Mica and Gasket Instead of Long Strips

"Sealed Beam" Lamps in "Hi-Lite" Illuminator

STEAM SHOWS RED

WATER SHOWS GREEN

Also available is Model MP-3000 for boiler pressures to 3000 psig

Complete Port Change and Cut Back into Service in Minutes Instead of Hours

Gauge Not Removed from Boiler for Gasket Changes and Other Normal Maintenance

End Stems Stainless Steel (Also Available with Flange Connections)

The individual round ports each having its own round glass, round mica and round gasket (instead of the conventional long strips) means less stress and strain . . . resulting in greatly reduced maintenance. When replacement is required, it is usually only one port . . . which can be changed in a very few minutes . . . and without removing the gauge from the boiler.

The Diamond Bi-Color feature is another important advantage of the MP-900 Multi-Port . . . steam always shows red and water always shows green. There can be no question of the water level.

Recommended for both new and old boilers up to 900 psig, the MP-900 Multi-Port will give you a new standard of gauge operation. Use the coupon below for additional information.

7757

DIAMOND POWER SPECIALTY CORP. CE
LANCASTER, OHIO

Please send me without obligation a copy of new Bulletin No. 2044 explaining the advantages of the Diamond MP-900 "MULTI-PORT" Bi-Color Gauge for all boiler operating pressures up to 900 psig.

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COMPANY_____

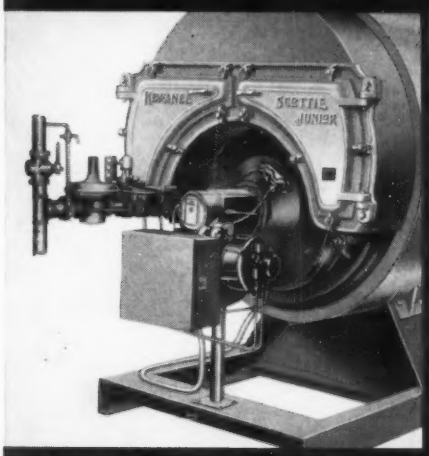
ADDRESS_____

DIAMOND POWER SPECIALTY CORP.

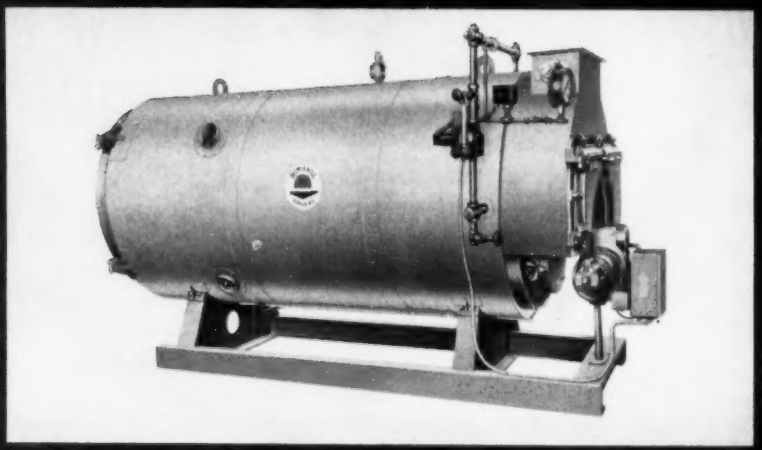
LANCASTER, OHIO

Diamond Specialty Limited • Windsor, Ontario

NEW! KEWANEE® FORCED-DRAFT



GAS-OIL COMBINATION FIRING for the new Kewanee package units is provided by this Kewanee burner designed for quick fuel change-over without adjustments.



NEW 606,000 TO 3,060,000 Btuh CAPACITIES: Kewanee Scottie Jr. low pressure boiler with Kewanee burner. Firing rate is balanced with boiler capacity. Oil burner (shown) is high pressure, twin nozzle type. Gas burner is equipped for either natural or LP gas.

another KEWANEE® quality product . . . proven in the field

Now . . . Kewanee provides 8 popular high pressure packages, 18 to 92 horsepower . . . 8 low pressure packages, 606,000 to 3,060,000 Btuh.

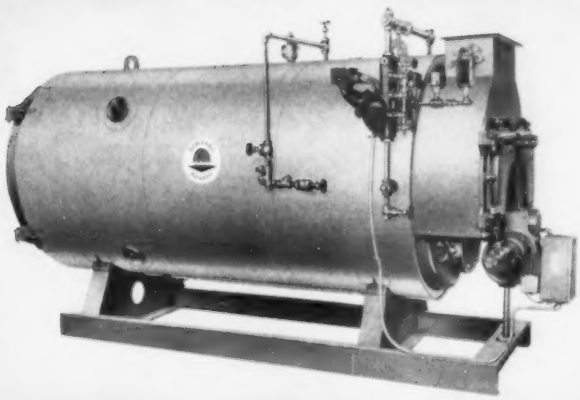
Forced-draft firing keeps combustion air supply constant, regardless of location or atmospheric conditions. Only a vent pipe is needed. The long, low lines of today's buildings are not violated by a costly, unsightly stack. Nor does the boiler room ceiling need to be higher than a standard 8 feet.

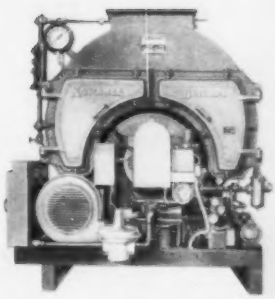
Fuel flexibility is provided by Kewanee burners for oil, gas or gas-oil combination firing. On combination units, fuel changeover is simple and fast . . . can be handled by automatic controls if desired.

Traditional Kewanee quality is engineered into the complete unit. Reserve strength is built into

18 TO 92 HORSEPOWER

PACKAGE UNITS





NEW 18 TO 92 HP CAPACITIES: For 125-150 swp or high temperature water above 250° F. Kewanee Scottie Jr. high pressure boiler with a Kewanee burner for oil (shown) or gas. Features include long gas travel, ample steam space, x-rayed and stress relieved welds.

OTHER LARGER KEWANEE BOILERS range up to 651 hp for high pressure . . . 21,855,000 Btuh for low pressure. Matching forced-draft burners are available for oil, gas and gas-oil combination firing.

all parts . . . moving parts are accurately machined to close tolerances. All features of design and construction are aimed at maximum dependability and long-range economy. Easy access is provided for boiler inspection and cleaning.

Kewanee factory-assembles the entire unit before shipping. The boiler is fitted with burner and controls at the factory, with controls housed in integral control panel. Boiler gages and controls are in place, as well as rear combustion chamber of high temperature refractory. Unit is shipped as a complete package—fire-tested if desired.

Send coupon at right for complete information. Clip it today and mail it to:

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101 Franklin Street, Kewanee, Illinois.

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FUSETRON

LOW-PEAK FUSES

Have

CURRENT LIMITING

added to

High Interrupting Capacity

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Long Time-Lag



Made in all standard sizes above 60 amperes

FUSETRON Low-Peak Fuses are made in all standard sizes above 60 amperes—both 250 and 600 volt ranges.

In 60 amperes and smaller sizes tests show that FUSETRON dual-element fuses have sufficient current limitation to protect circuit and components in all normal cases.



Now you can have a high degree of protection against the thermal and mechanical stresses that heavy fault currents often impose on switches or other circuit components.

FUSETRON Low-Peak Fuses have a current limiting element that cuts off fault current so fast that it cannot build up to a damaging peak.

These new FUSETRON Low-Peak Fuses are built on the same principle as FUSETRON dual-element Fuses. They have:

the same High Interrupting Capacity

the same Time-Lag to hold harmless current surges

PLUS Greater Current Limitation to restrict fault currents to a LOW PEAK

FUSETRON Low-Peak Fuses can be interchanged with FUSETRON dual-element Fuses.

Where their use is required in any part of the electrical system, they can be installed without upsetting proper coordination over the range of useful loads and normal faults.

Hence, their application requires no testing or complicated calculations.

They are designed for use to protect circuits and components that might be damaged by the thermal and mechanical stresses of peak fault currents if other protective devices are used.

If planning new installations, keep FUSETRON Low-Peak Fuses in mind for those locations where peak fault current must be held to a low value.

BUSSMANN MFG. DIVISION

UNIVERSITY AT JEFFERSON, ST. LOUIS 7, MO.

McGRAW EDISON



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The Word *from* Washington



EDGAR A. POE
Consulting Engineer Correspondent

NEW engineering techniques are being developed in the construction of the vast Federal highway program. This was brought out by delegates attending the annual winter meeting of the Highway Research Board in the Nation's Capital. These stoplight-free high speed highways demand better materials, and specifications are being raised to call for the very highest types of bituminous pavings.

It was brought out that engineers in some sections have found soils data, of a primarily descriptive rather than technical type, to be useful in highway design. For example, the same general information farmers have used to cut down on erosion also will aid in curbing highway erosion.

Another growing trend among the highway departments is the employment of the aerial photography techniques for surveys, especially in areas of rugged terrain.

The Maine Highway Commission has greatly reduced time-consuming and expensive field reconnaissance surveys by the use of aerial photography. To obtain information for final designs, however, detailed field investigation and laboratory testing still is required. Predictions among highway officials are that more intensive and specialized photographic interpretation studies will be employed in the near future in this connection.

SEEMINGLY there are two avenues left open to keep the Department of Labor off the backs of consulting engineers. Either Congress will have to pass specific laws declaring that the Wage-Hour law does not apply to consulting firms, or the Supreme Court of the United States will have to affirm a recent decision of the Fourth Circuit Court of Appeals in the Lublin, McGaughy case.

NUMEROUS bills of marked interest to consulting engineers and the engineering field in general are pending before Congressional committees. The House Ways and Means Committee, where all tax legislation must originate, has received an appeal from the National Society of Professional Engineers in behalf of the Jenkins-Keogh bill. This measure would authorize self-employed persons to deduct from their gross income tax certain sums they set aside for retirement annuity insurance. However, one of the top Democrats on the committee said he thought there was "little or no chance" of the Jenkins-Keogh bill passing Congress this session.

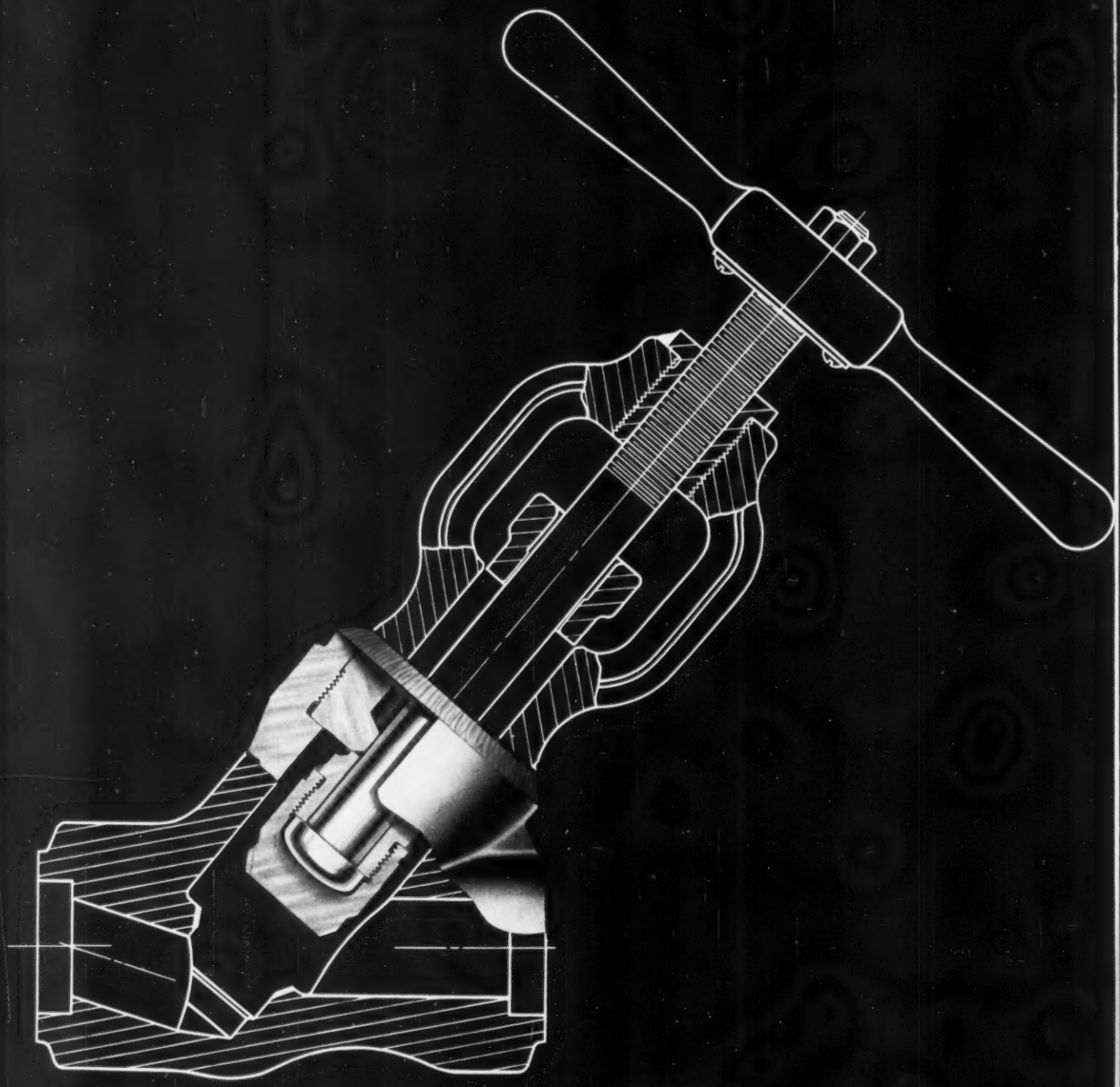
THE Social Security payroll tax is going to get tougher and tougher in the years ahead. At the present time an employee and an employer each put up $94.50 a year on the first $4200 of income, a total of 4½ percent. However, few people realize that under the law this 4½ percent will rise to 8½ percent by 1975.

HEARINGS before the House Armed Services Subcommittee, headed by Representative F. Edward Hebert, of Louisiana, have served to point up a disagreement between the Air Force and the Army Engineers as to the type of pavement needed for military airports. The technical discussions involved weight loads at the military fields. Loads now run from 240,000-265,000 pounds. However, some witnesses predicted that future requirements on military airfields will be for a pavement designed to carry a 325,000-pound aircraft.

THE Department of Commerce's revised estimate of the Federal-State share of the cost of completing the Interstate System from $27.6 billion to $37.6 billion was a mild shocker to Capitol Hill. Although nearly everyone on the House and Senate Committees dealing with the program knew it was going to cost substantially more than original estimates, few expected a $10-billion increase. Now some members of Congress say that the total cost of the authorized Interstate Program alone will likely exceed $40 billion.

The nationwide traffic forecasts for 1957, made subsequent to the 1956 Act, are 15 percent higher than previous estimates. Therefore, more traffic lanes and other facilities are going to be needed.

Highway construction costs of the Interstate System rose 12 percent between mid-1954 and the last half of 1956. Also, miscellaneous items such as utility adjustments, lighting, signals, and incidentals account for an estimated 3-percent increase. ▲▲



EDWARD UNIVALVE

What's New from Edward Valves, Inc.

New Products . . . Problems and Solutions. . . Information on Steel Valves from Edward, Long-Time Leader in the Field!

Shoulder, thread and weld make

Superior "Univalve" Body-Bonnet Joint

Edward valve researchers were assigned three main goals in developing the Univalve* . . . first, design a globe valve for high pressure-temperature service—that would *stay* leak-proof . . . second, eliminate—as far as possible—the necessity for maintenance . . . third, fabricate all pressure-containing parts of forged steel for maximum strength and soundness.

How well they succeeded is illustrated by this fact: in many hundreds of advanced temperature-pressure applications all over the world, Edward Univalves have given consistently superior service. The *reason* for this is simple . . . Univalves, properly maintained, simply do not leak.

WELD SEALS JOINT

In the Univalve, a bead of fine-grained weld seals the body-bonnet joint to maintain perfect pressure tightness in any service. A guiding section above the threads protects them from the seal-weld; the threaded section and body shoulder carry the pressure load and insure accurate alignment. The rugged threaded bonnet—with opening just large enough to accommodate the stem—provides a pressure-tight backseat. The radiused disk nut contacts the beveled bonnet backseating surface . . . isolates packing from line pressures and temperatures . . . stretches packing life.

While the Univalve rarely needs attention, even its tough integral Stellite seating surface *can* become scored under some conditions. To strip for inspection and possible re-lapping, the seal-weld is easily removed by machining or grinding or with carbon arc or oxy-acetylene scarfing tip. Besides simple disassembly and positive backseat advantages, Univalve's one-piece gland eliminates possible small parts loss during repacking.



IDEAL FOR BLOW-OFF SERVICE. Univalves meet ASME Code for blow-off service and are adaptable for all high pressure installations.

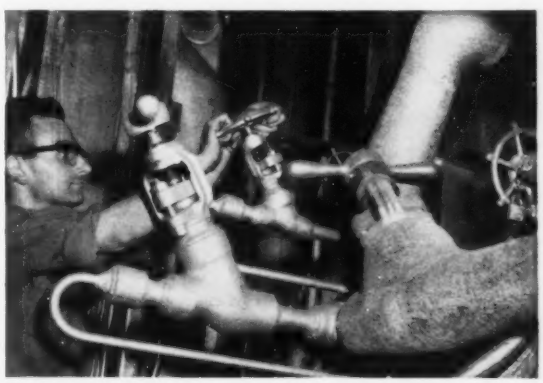
IMPORTANT UNIVALVE FEATURES:

Streamlined Flow Path reduces pressure drop, minimizes wear-producing turbulence. Univalve meets requirements for blow-off service.

Simple Packing Adjustment keeps packing maintenance down. Sturdy gland bolts, roomy yoke, one-piece forged gland.

Easy Open—Tight Close Operation of all Univalves 1¼" to 2½" made a reality with the exclusive Edward Impactor* handle.

Continuous Stellite Ring applied to body and disk, retains hardness under temperature and resists wear.



4500 LB UNIVALVE in service at Ohio Power Company's supercritical Philo station.

*T.M. Reg. U.S. Pat. Off.

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Subsidiary of ROCKWELL MANUFACTURING COMPANY

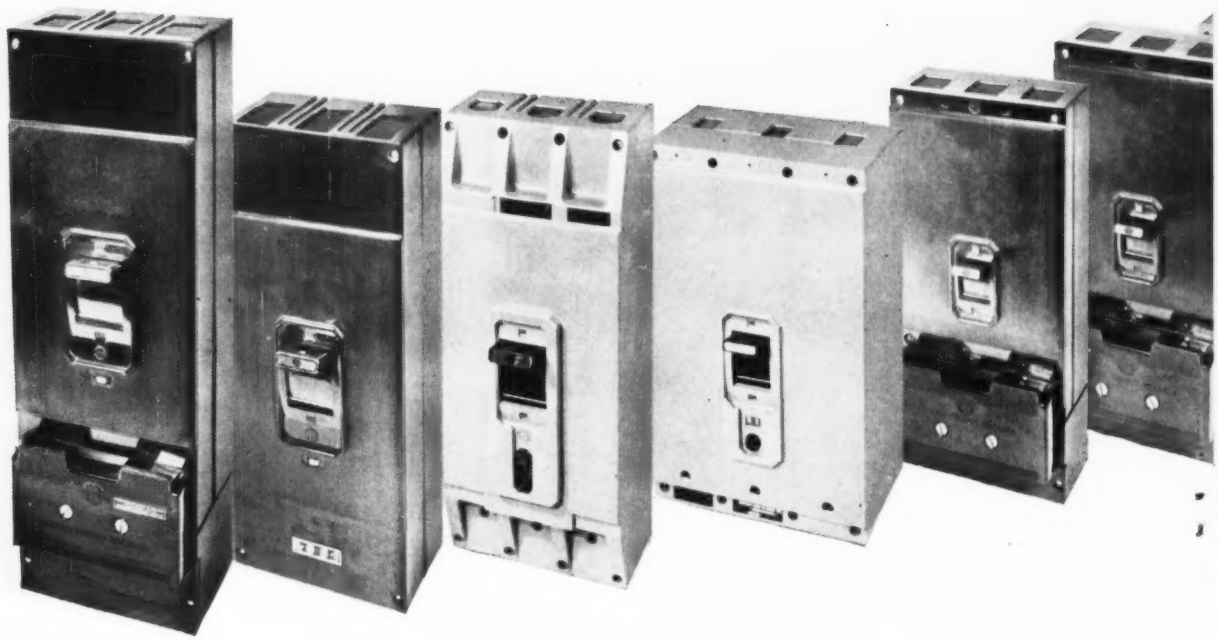
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Edward builds a complete line of forged and cast steel valves from ⅛" to 18"; in globe and angle stop, gate, non-return, check, blow-off, stop-check, relief, hydraulic, instrument, gage and special designs; for pressures up to 7500 lbs; with pressure-seal, bolted, union or welded bonnets; with screwed, welding or flanged ends.

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From the smallest circuit breakers for lighting circuit protection, through I-T-E's exclusive Cordons—with 100,000 amp interrupting capacities—to the many special-purpose breakers, such as the 400 cycle, 1000 v selective trip breaker designed for Navy use, I-T-E molded case circuit breakers constitute industry's most complete line.

Not only is the I-T-E line the most complete and most diversified, but I-T-E's famed "extra quality—at no extra cost" is built into every product which bears the I-T-E label. And you can depend on the nation-wide network of I-T-E distributors and field engineers to give you second-to-none service. I-T-E Circuit Breaker Co., Small Air Circuit Breaker Division, 19th and Hamilton Streets, Philadelphia 30.

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PHILADELPHIA, PENNSYLVANIA



The Legal Aspect

MELVIN NORD, P.E.
Consultant in Legal and Technical Problems
Patent Attorney

The Law of Real Property : General Principles

ENGINEERS may not own much property, but they nevertheless are required to know something about it, especially in connection with construction work. This is especially true for real property.

Real and Personal Property

"Real property" is a legal term that is not to be contrasted with "unreal" or "imaginary" property, but rather with "personal property." Since personal property cannot be defined accurately except as "property other than real property," we cannot define real property by this roundabout route.

Anyone who has lived on this planet for any substantial length of time must have noticed that some kinds of property are movable and others are immovable. This is the beginning of wisdom in making the distinction between real and personal property, since the movable type generally is called personal and the immovable type generally is called real. However, while this may be the beginning of wisdom in this area, it is not the end. It is a clue worth following up.

The principal immovable type of property is land, and the ownership of land is the cornerstone of all real property law. There are many reasons why the ownership of land, as distinguished from other types of ownership, requires an entirely separate category in law. For one thing, land is factually and legally unique. One gallon of gasoline may be indistinguishable, for all practical and legal purposes, from another, or one bushel of wheat from another, or one dollar from another — but Blackacre is always distinguishable in fact and in law from Whiteacre. Thus, some kinds of personal property are "fungible" or interchangeable, but land is, in fact and in law, never fungible. It is unique because it is in fact a specific geographically locatable portion of the territory of the earth. An adjacent piece of land of the same size and shape is no substitute for My Old Kentucky Home.

It may be that one piece of land will be condemned for a highway at a relatively low value, and the adjacent piece of land will become the site of a skyscraper rendering the land extremely valuable. It may be that in one piece of land when you drill for drinking water you get nothing but brine while in the adjacent land you get nothing but oil. In one there may be gold, and in the other fool's gold. One may be good for growing crops; the other may blow away. Thus, in law, if one is entitled to a particular piece of land, in general he cannot be forced to accept a substitute. On the other hand, the normal result with personal property is the opposite — he must accept money damages as a substitute except in certain unusual situations.

Land is Here to Stay

Another reason land is treated differently from other forms of property in the law is its permanency. A gallon of gasoline, a book, or an automobile some day will be gone, but land lingers on forever. There is no practical way to get rid of it without getting rid of the planet at the same time. As a result, it is much easier to get confused about who owns it. If some confusion arises about who owns a new automobile, we know that the contestants sooner or later will lose interest, as a new model soon will be out and the formerly new one will be on the junk heap. But there is no junk heap for land. It is not uncommon to have lawsuits brought by persons who claim to trace their title to land back more than a hundred years. Thus, the ownership of land must be governed by rather strict legal rules, requiring written deeds, registration of deeds in public offices, and rules of inheritance.

Land is also different from personal property in that it is indispensable. Some people may live their entire lives without having the use of an automobile, a book, or a painting, but no one thus far has managed to get by without the use of land. Up to the present time most of us have had to have some place on earth to rest our weary bones. This has meant that there always has been a demand, by the landless, for the use

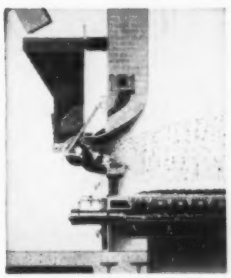
CHOOSE STOKER FIRING FOR ECONOMY AND SATISFACTION

Coal, Burned With a DETROIT STOKER Offers Many Advantages, Proven By Thousands of Installations

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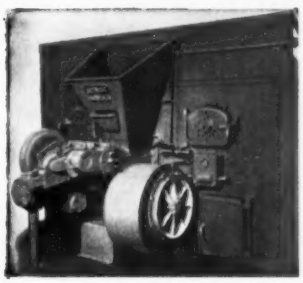
One of these Detroit Underfeed or Spreader Stokers will save you money—they are backed by over a half century of experience.

DETROIT ROTOSTOKER



Spreader stoker with OVERTHROW ROTORS that distribute the fuel uniformly in the furnace. Fine particles burned in suspension and coarse coal, burned on the grate. Four types of grates are available. RotoStokers burn successfully an extremely wide range of fuels without any special preparation. In combination with coal, RotoStokers also successfully burn wood and other refuse.

DETROIT UNISTOKER



Plunger feed, side-cleaning stoker is available in various sizes for 125 to 250 horsepower boilers. Full-housed blower either motor or steam turbine driven, mounted at stoker front. Adjustable Feed provides for either manual or automatic coal feed control.

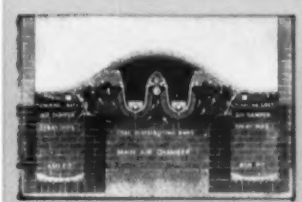
DETROIT ROTOSTOKER TYPE C-C

(Continuous Cleaning)



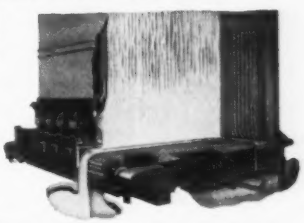
An important addition to the comprehensive "Detroit" line of spreader stokers. Readily applied to small and medium size steam generators approximately 5,000 to 75,000 pounds of steam per hour. The continuous cleaning grates automatically discharge the ash at the front for easy removal. No basement needed.

DETROIT DOUBLE RETORT STOKER



A multiple retort stoker having two retorts, with the side-cleaning feature requiring no basement. Now available with Detroit Adjustable Feed Coal Feed Control. For medium sized boilers.

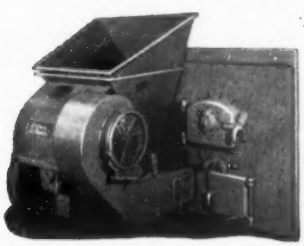
DETROIT ROTOGRATE STOKER



Spreader stoker with FORWARD MOVING GRATES for medium and large boilers up to approximately 400,000 pounds of steam per hour. Screenings or crushed run-of-mine coal used without grinding or pulverizing. Successfully burns a wide range of fuels, including lower grades of Bituminous Coal and Lignites . . . with preheated air if desired. Higher burning rates for longer periods with low excess air and without slagging or clinkering difficulties. Combustible in ash is unusually low.

DETROIT LOSTOKER

Has Detroit Adjustable Feed (Coal Feed Control).



A complete firing unit. Compact—single retort—mechanically driven—plunger feed—side-cleaning design. Many sizes and capacities for various types of boilers. Simple, accessible, dependable. A great coal saver.

DETROIT STOKER COMPANY

Main Office and Works, Monroe, Mich.

District Offices or Representatives in Principal Cities

INVESTIGATE DETROIT STOKERS — IT'S THE ROAD TO ECONOMY AND SATISFACTION

of land – and landlords to supply it. As a result, a complicated set of legal relationships has arisen, regulating various partial interests in land (such as the interest of a tenant) as well as so-called future interests – interests not at present possessory but will or may in the future become possessory.

In addition, there are legal problems having to do with the boundaries of ownership of land – problems that do not arise in connection with personal property. Not only is there the surveying problem of locating the boundaries on the surface of the earth, but there are also the legal problems of defining the distances up and down from the surfaces that are regarded as within the ownership of the land. There are also legal questions relating to mineral rights and water rights. And there are the problems that arise when one owner uses his land in such a way as to interfere with the use of someone else's land. You cannot pick up and move your land away from an unreasonable neighbor.

Thus, it is clear that there are many good reasons why the laws relating to the ownership of land require a separate category in the law – the law of real property.

What is Real Property?

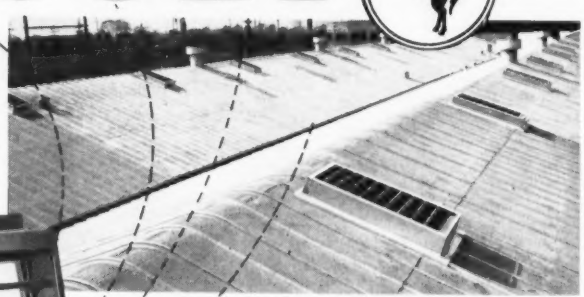
As may be evident, the law of real property includes not only the ownership of land but also the ownership of certain legal interests in land. Many interests in land also are characterized as real property, but not all are. In general, important interests such as mineral rights or the right of way over someone else's land are classified as real property, but for purely historical reasons, the interest of a tenant is a cross between real and personal property. This is called a chattel real.

It also must be understood that the term "land," as used in real property law, does not mean just the dirt in a given locality. It means a geographically locatable portion of the earth, including a portion of its surface and portions of space extending upwardly and downwardly from the surface. The mineral contents of this portion of the earth also are included in the land, and so are fixtures – buildings or objects that are more or less permanently attached to the land.

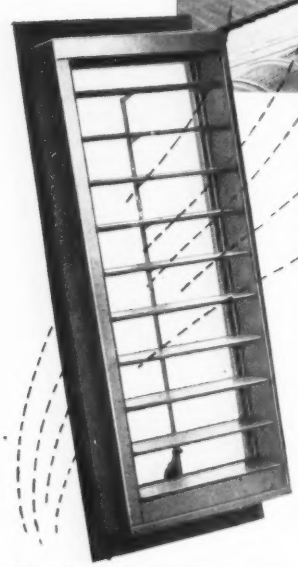
Problems in Real Property Law

In future articles in this series, we will discuss a number of important phases of real property law, including the following: (1) location of the surface boundaries of land; (2) determination of the ownership space above and below the surface of land; (3) acquisition and transfer of ownership of real property; (4) types of estates or interests in land; (5) liens and mortgages on land; (6) rights and duties of owners of real property; (7) rights in the land of another person; (8) mineral rights; (9) water rights; (10) dedication of land to public use; and (11) taking property under the power of eminent domain. ▲▲

Another Southern California Firm Selects
VENTILATION BY
COLT



ELECTRA MOTORS, Inc., Anaheim



And when you're selecting a ventilation system for your clients, you'll want to specify COLT. Here's why:

Efficiency and economy—COLT ventilators perform double duty, space ventilation with properly circulated air within the building and, in addition, provide fire protection. (Fire authorities everywhere agree that fire control in industry must include modern and efficient fire venting.)

No operating costs—no machinery or gears, nothing to repair or run up power bills.

Complete selection—COLT manufactures a wide variety of clear-opening, weather-proof ventilators for roof or wall.

Lightweight—with built-in controls, endless control cord. Heavy gauge anti-corrosive hardened aluminum.

Extra fire protection—Louvers open down automatically in event of fire. Wide, unrestricted free area allows immediate escape of heat and smoke . . . and many other features fully described in free pamphlet, *"Some Aspects of Fire Prevention in Industrial Buildings," by M. J. Reaney, and a free technical manual giving full details of the COLT system.*

CO/2046 COLT Clear Opening Adjustable Louver Ventilators.

ANOTHER FINE PRODUCT BY

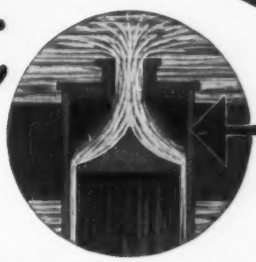


COLT VENTILATION OF AMERICA, INC.

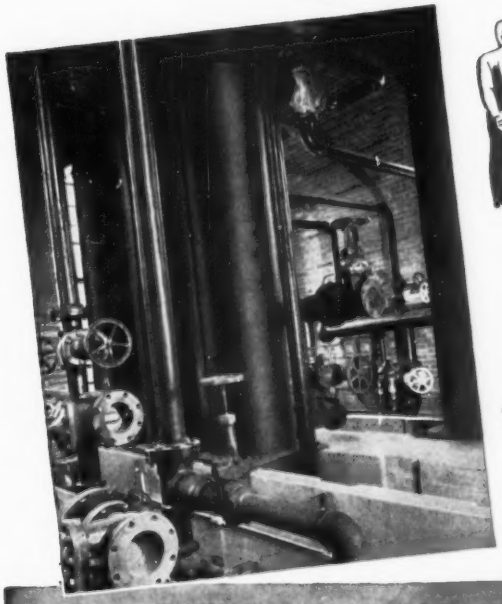
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Dirty Water can't "Shut-down"... Vogt film type exchangers





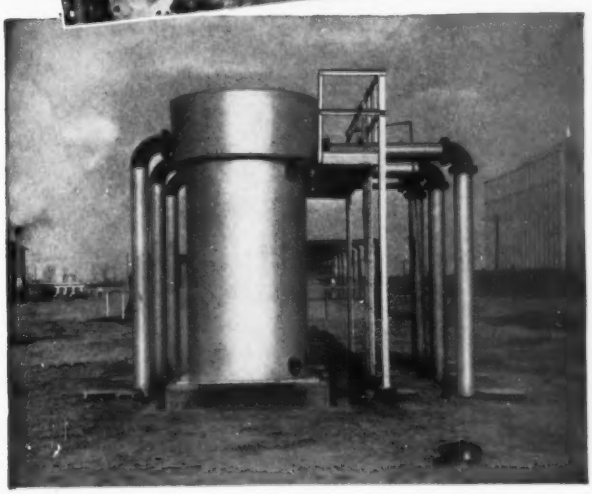






(Condensers—Coolers—Evaporators)

Patent Nos. 1,935,270 - 2,057,597 - 2,424,441



River water, well water or brackish water are all alike to this exchanger *because it can be cleaned* while in operation! The water distributing ferrules need only be removed successively for the cleaning brush or tool whereby the tubes receive additional water which sluices away the dislodged dirt.

Vogt Film Type Exchangers are operating with real economy of first cost, operation and maintenance in power, petroleum, and chemical industries. They serve as Jacket Water Coolers, Feed Water Heaters, Hydrocarbon Evaporators, Sulphuric Acid Coolers, and Sulphur Dioxide Condensers, and can be designed to cool or heat any liquid and to condense or evaporate any fluid.

TOP: *Four units at Newton Falls, Ohio Municipal plant cool water for diesel engines and a lubricating oil cooler.*

BOTTOM: *Jacket Water Coolers serving engines of 7,300 HP in the compression plant of a Western Oil Refinery.*



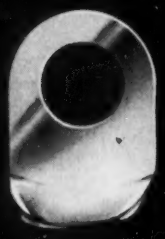
[Bulletin HE-7 describes typical installations of Vogt Film Type exchangers and is available upon request. Address Dept. 24A-XCE.]

HENRY VOGT MACHINE CO., LOUISVILLE, KY.

Sales Offices: NEW YORK, CHICAGO, CLEVELAND, DALLAS, PHILADELPHIA
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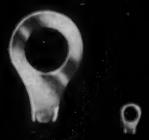
AMP COMPRESSION for the





ALL TERMINALS SHOWN ACTUAL SIZE



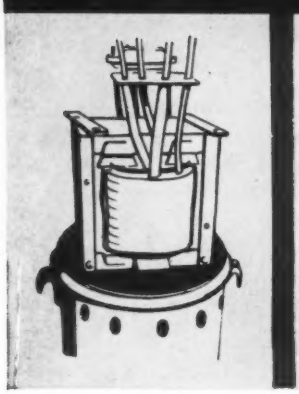


SOLISTRAND®
22-600 MCM AWG

Ampli-Bond®
8-4/0 AWG

DIAMOND GRIP
26-10 AWG

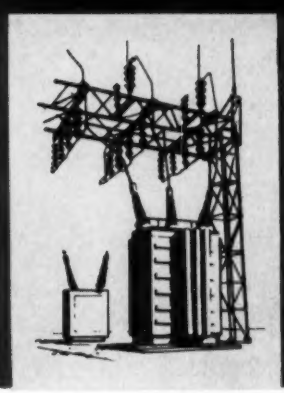
PRE-INSULATED DIAMOND GRIP
26-10 AWG



SOLISTRAND Butt and Parallel Connectors for innercoil connection to leads. SOLISTRAND Terminals on outside leads of transformers.



PRE-INSULATED DIAMOND GRIP and DIAMOND GRIP Terminals and Connectors for switchgear panel wiring in generator plants and sub-stations.



SOLISTRAND and AMPLI-BOND Terminals and Connectors for construction and maintenance of generator plants and sub-stations.



PRE-INSULATED DIAMOND GRIP and SOLISTRAND Terminals and Connectors for street and traffic light installation and maintenance.

TERMINAL PRODUCTS UTILITY INDUSTRY...

AMP's diversified lines of terminal and connector products . . . and matched precision-engineered application tooling . . . have been part of the utility industry's components story, in many ways, for many years. These products have been designed for the exacting requirements of the electrical industry in general, and a predominant number of original equipment items depend on the AMP method of termination and connection for service reliability.

AMP's diversified lines of terminal and connector products include:

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Ampli-BOND® —provide full insulation support for large wire sizes. They are bonded and reinforced to prevent relaxation of cable support.

DIAMOND GRIP —non-insulated, but having metallic sheath to provide full circumferential support to cable. Excellent for applications where resistance to vibration is a factor.

PRE-INSULATED DIAMOND GRIP —insulated with tough plastic that won't come off . . . it's bonded. Affords optimum performance under vibration.

Some typical applications of these A-MP products are shown below.

AMP's continuing programs of research and development are increasing the potential of newer products to speed operations, reduce costs, and improve reliability for all phases of utility activity.

A-MP products, when required for maintenance and repair needs, are available in the U. S. A. through American Pamcor Inc. api AMERICAN PAMCOR INC.

For additional information write to:

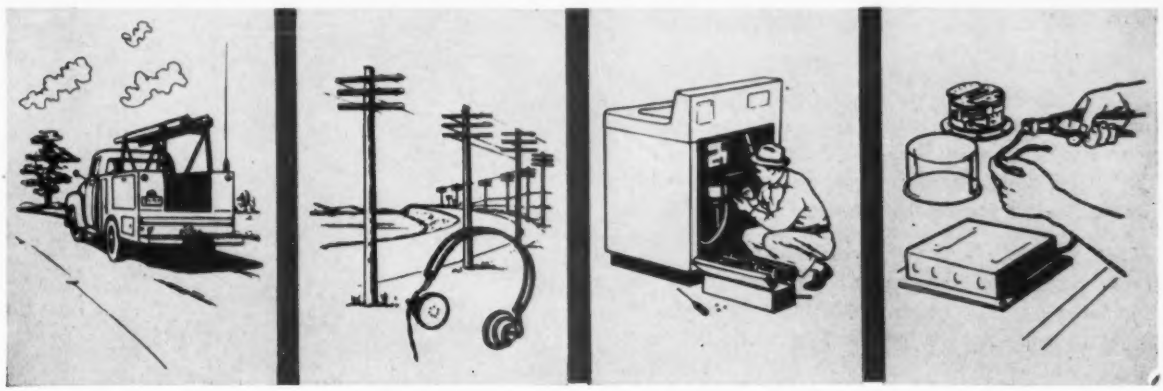
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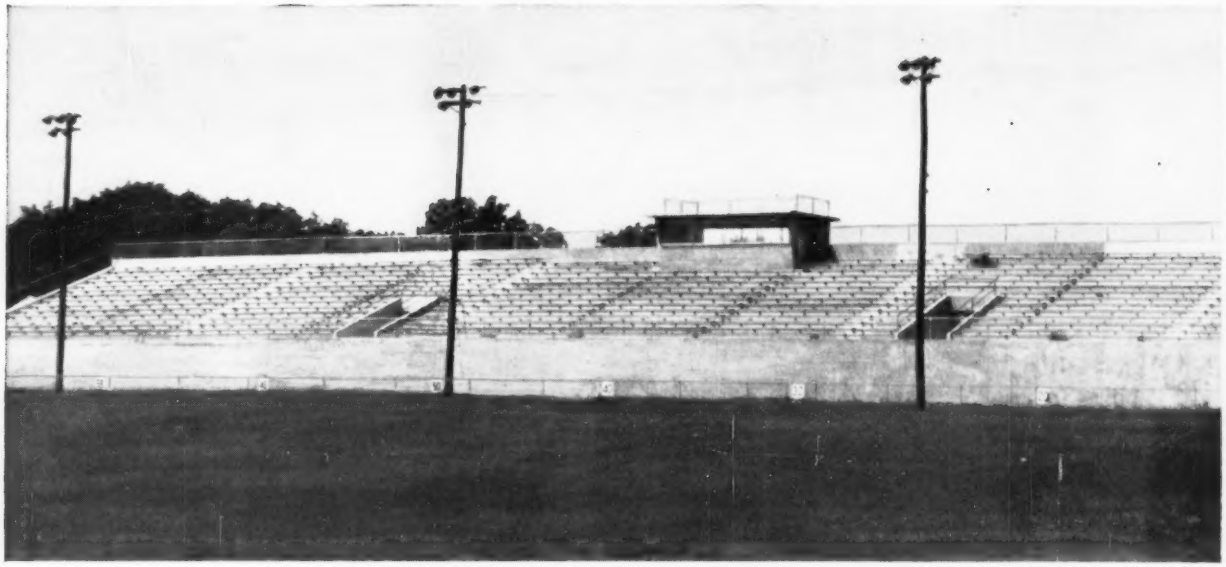
PRE-INSULATED DIAMOND GRIP, DIAMOND GRIP, and SOLISTRAND types find extensive usage in truck and car fleet maintenance.

PRE-INSULATED DIAMOND GRIP Terminals and Connectors for communications equipment.

PRE-INSULATED DIAMOND GRIP, DIAMOND GRIP and SOLISTRAND types for appliance repairs.

PRE-INSULATED DIAMOND GRIP, DIAMOND GRIP and SOLISTRAND types for meter repairs.

Getting Ready Fast for



Anderson Field Stadium in Fort Valley, Georgia. Manufacture and erection of this 2900-seat stadium was performed by Macon Prestressed Concrete Company, Macon, Ga. 7/16" Union Tufwire strand was used exclusively in the stadium slabs, which were erected in less than 5 days working time.

Owner of the structure is Peach County Board of Education, Ernest R. Anderson, superintendent.
Architects: Warren & Riley, Macon, Ga.
Structural Engineer: W. H. Armstrong, Macon, Ga.
General Contractor: Homer Davis, Ft. Valley, Ga.

Prestressed Concrete Seating Slabs Go Up In 5 Days

Ever watched a circus crew race against time to set up the seats before the ticket window opened? Concrete stadiums go up these days with comparable speed — thanks to prestressed concrete.

While the supporting stringers were being erected on the site, the Macon Prestressed Concrete Company cast and prestressed the special seating slabs for the Anderson Field Stadium, Ft. Valley, Ga. In just 5 days, the slabs were set in place ready to attach seats for 2900 sports fans.

This project is another demonstration of the adaptability of prestressed concrete. Here are a few of the many other prestressed concrete products in wide use: I beams, T purlins, tilt-up and tongue-and-groove siding; channel panels and slabs for floors and roofs; pipe and tanks; fence and lamp posts; highway and airport slabs; bridge and wharf piling; slabs, stringers and girders; complete warehouses, shopping centers, stadiums, gymnasiums, schools and commercial and industrial buildings. Experimental work of utmost promise is now under way on highway slabs.



Easy, fast transportability of prestressed structural members is a big advantage of prestressing. Here the stadium seating slabs are being hoisted from truck to position on the stadium stringers.

the Big Game



"The New Age of Concrete": What Will It Mean to You?

The construction industry has fielded a team that compares in speed with old methods like a 50-yard pass outstrips the slow advance of a ground attack.

The "team" is prestressed concrete construction. And speed is just one of the features that make it today's miracle building material, with a future unlimited.

Reporting on the recent progress in prestressed concrete, the Concrete Industries Year Book, 1957, says:

"In less than a mere half-dozen years prestressed concrete has grown from nothing to a building material which must be reckoned with in all construction in the future."

Here are some of the reasons why the industry has grown at rates of from 200% to 300% per year.

Prestressing increases tensile strength of concrete many fold. Less concrete and less steel are needed. Strength-to-weight ratio is high. Longer spans and thinner sections are possible. Prestressing combines the permanence of concrete with amazing flexibility and elimination of cracking. The savings it makes in time and money mean more profit for suppliers and constructors — greater value for owners and taxpayers.

Prestressing offers you big opportunities whether you use it as an on-site contractor with portable prestressing beds, or become a permanent site fabricator of concrete products of any description. And our own engineers will work closely with you or your consulting engineer on your stress-relieved wire and strand specifications.

Today Union Wire Rope Corporation is supplying the mounting demands for Tufwire high tensile wire and strand with on-schedule speed and dependability. And we're gearing to future needs — with technical know-how, expanding production facilities and research.

Get in touch with us now.



Savings in time and labor are pointed up by this view of slab being hoisted into place. No forms to build, no waiting on the weather nor materials in short supply.

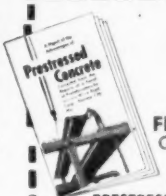


Here is a close-up view of the completed stadium, erected in record time to add another laurel to the achievements of prestressed concrete. The strength and resilience of the prestressed seating slabs provides a high safety factor for the combination of load and vibration imposed by excited fans.

union **Tufwire**®



Stress-Relieved Wire and Strand



FREE! Get your copy of **PRESTRESSED CONCRETE ADVANTAGES** compiled from the reports of a panel of Prestressing Fabricators.

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Report from the West Coast

RALPH S. TORGERSON
CONSULTING ENGINEER CORRESPONDENT

THE CONSULTING ENGINEERS Association of California held its annual meeting at the Miramar Hotel, Santa Barbara, Calif., Jan. 18 to 20. The increasing encroachment of government into the field of the consulting engineer, the need for more adequate fees, competitive bidding, and mandatory registration of engineers were some of the major problems discussed at the meeting.

President's Address

President Ralph M. Westcott opened the business meeting with a report reviewing the activities of the Association during the year. He warned that the demand for union labels on engineering drawings, which was denied by the Los Angeles Board of Public Works, will require continued watchfulness, as the union has not abandoned its efforts.

During the year there was a net gain of six members. Total Association membership now is 179.

Commenting on the Consulting Engineers Council, President Westcott reported nine new associations had been taken in since the original group of 10 organized the Council; new associations are being formed or contemplated in 15 more states. He said that the Council was growing in stature and has been recognized as the spokesman for consulting engineers by the Defense Department and other governmental agencies with respect to clarification of basic policies to be followed in the selection and negotiation for engineering services. CEC is now the consulting engineer's spokesman at the national level with such national groups as AIA, manufacturers' associations, contractor groups, and the technical societies. The CEC has accepted the invitation of the California Association to hold its annual meeting in San Francisco, at the Sir Francis Drake Hotel, May 1 to May 3, 1958.

President Westcott said that the California Association was in sound financial condition with a slight surplus for the year. He commented on the proposed amendments to the bylaws encouraging increased participation of corporations and partnerships. This would provide additional income from dues and cover CEC membership without resorting to assessments or an over-all increase in the dues structure.

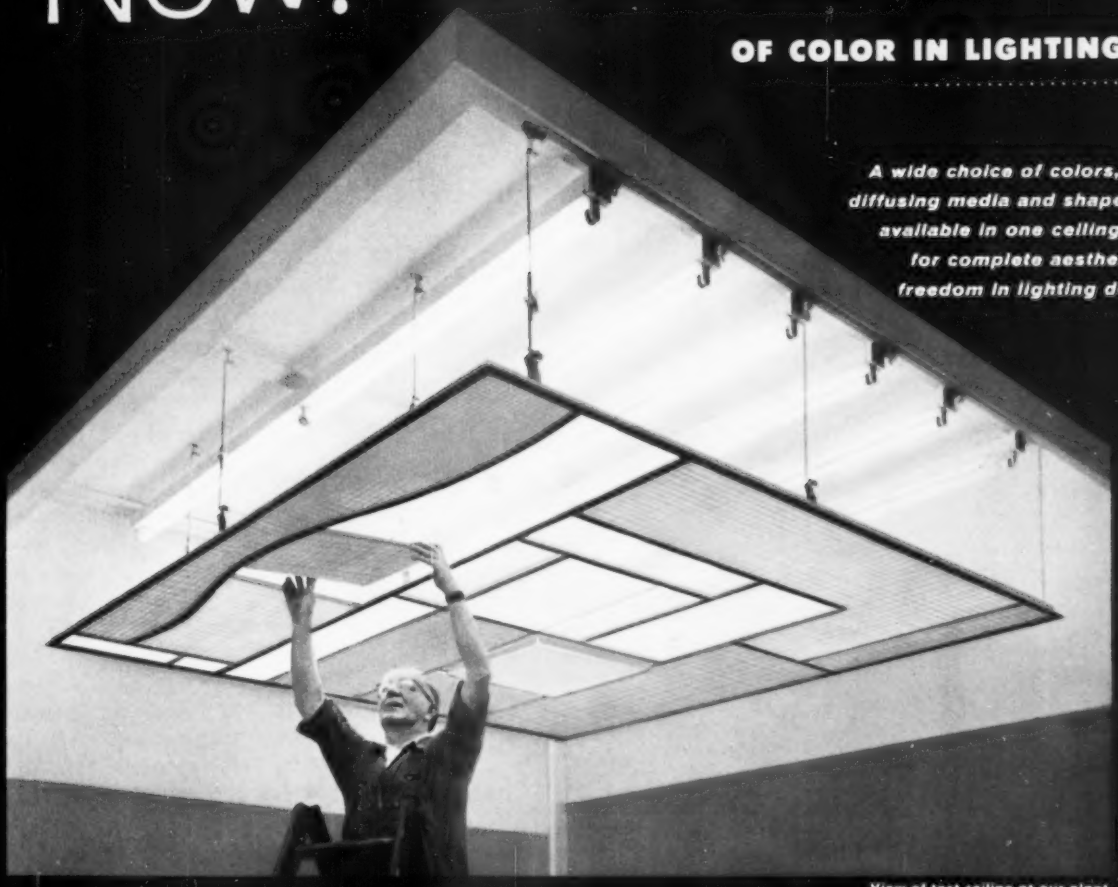
Turning to the question of mandatory engineering registration in California, Mr. Westcott said that the problem mainly concerned mechanical and electrical engineers but any legislative action would include chemical and petroleum engineers. The elec-



NEW CEAC PRESIDENT HAROLD KING (LEFT) TAKES OVER FROM PAST PRES. WESTCOTT.

Now! CHOOSE FROM A RAINBOW OF COLOR IN LIGHTING!

A wide choice of colors, diffusing media and shapes available in one ceiling system for complete aesthetic freedom in lighting design



View of test ceiling at our plant.

Electro Silv·A·King **LUMENAREA** ceiling system

The simplest, most versatile installation system ever developed!

Here is the world's first large area lighting system that gives you practically unlimited variety of form, as well as color and diffusing media. Now you can design lighting layouts, from the conventional to the abstract, curved or straight in any combination of louver, molded forms, glass and accent lighting . . . in soft pastel pink, blue, green and white . . . in a ceiling completely free of any visible screws, bolts or mechanical devices.

And with all that, the new Electro Silv-A-King LumenArea System, incorporates Slide Adjustment and Adjusto-Lok hanging devices which adjust for spacing and depth *without tools!*

Design of our Overlap Polycube® Louver (⅛" cube), on 2-ft. wide modules eliminates the necessity for crossbars, regardless of how long the run . . . also provides 45° x 45° shielding for optimum seeing comfort.







Dished plexiglas ceiling with perimeter of green "Polycube" Louvers helps give this office a distinctive appearance.

For your Free Specification and Data Bulletin, write to:

Electro Silv-A-King Corporation, 1535 SO. PAULINA ST., CHICAGO 8, ILL. • SPRUCE & WATER STS., READING, PA. • REDWOOD CITY, CALIF.



EYE-HYE

gives quick, accurate boiler water level reading for each drum at new automotive plant

Close-up of one of three panels shown below, in power plant of Chrysler Stamping Plant, Twinsburg, Ohio.



Here, as in thousands of other plants, operators "keep tab" on boiler water levels easily, quickly — with EYE-HYE conveniently mounted on panel or wall where wanted.

EYE-HYE is simple, safe, sure — easy to read from its illuminated green indicating liquid. It is sensitive to slightest level changes. Has no mechanical parts — is completely hydrostatic. Set at factory for the boiler it's ordered for; no adjustments or tampering possible on location. EYE-HYEs are available for any boiler pressure.

As an extra precaution, if warning signals are wanted, EYE-HYE can be equipped to actuate auxiliary lights and/or horns in various parts of the plant.

There are many uses for EYE-HYE Remote Reading Gages. Besides the main boilers, it can do valuable service on feed water heaters, waste heat boilers, flash tanks, storage tanks, etc. When writing for information, mention your working steam pressure.

The Reliance Gauge Column Co., 5902 Carnegie Ave., Cleveland 3, Ohio

Reliance EYE-HYE
Remote Reading Gage
All-hydrostatic • Reads like a tubular glass gage

trical engineers in Los Angeles, he said, made a constructive step forward when the Los Angeles Electrical Code was revised so as to require a registered electrical engineer to sign permit plans for installations above a specified load capacity. He pointed out that every consulting electrical and mechanical engineer is affected when contractors and manufacturers are permitted by law to perform engineering services with unregistered and often unqualified personnel.

President Westcott then made a plea for members to bolster the professional standing of all engineers by rigorously opposing competitive price bidding, a practice that leads to economic suicide.

Membership and Dues

A considerable discussion evolved about the question of membership and dues. It was the consensus that the membership should be increased and that an expanded membership would help the Association to gain recognition for the profession in legislative and other questions before governmental agencies. President Westcott pointed out that each member should submit at least one name for membership.

S. B. Barnes, co-chairman, presented the report of the Policy Committee. The committee recommended several changes in the bylaws. One change, designed to increase membership, provided that where one member of a firm belonged, all members of a firm and officers of a corporation should be members of the Association. It also was agreed that the dues for the member having the greatest earnings would be assessed on the same basis as an individual member. The dues for all other partners or officers of a corporation who are members of the Association would be assessed 50 percent of the amount set forth in the dues schedule.

Another bylaw change provided that where more than one member of a firm or officer of a cor-

Some Things to Think About Steam Traps

. . . in order to get high operating efficiency and a minimum of maintenance

The gentleman who invented the wheel had a basic idea and so far no one has come up with anything better for the purpose.

If you'll pardon us for a little overemphasis on the significance of steam traps, we'd like to liken one of them to the wheel.

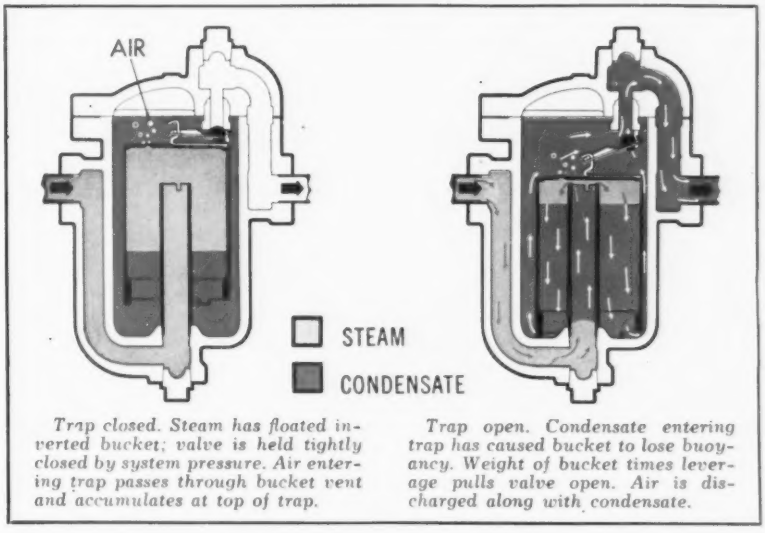
In 1911, when the first Armstrong inverted bucket steam trap model was announced to the world, or at least that part of the world that modest advertising and sales budgets would cover, it was not received with equal enthusiasm by all (especially old-style trap makers). But, like the wheel, it managed to find its way into general use. And, nothing better has ever turned up for the purpose of draining condensate. As a matter of fact, the Armstrong trap has been very widely copied. Today, there are more inverted bucket traps draining process equipment than any other kind. Of these, there are more Armstrongs.

If this sounds like the boasting of a proud parent, give consideration to some fundamental requirements not met by all traps:

1. ***A steam trap should not leak steam.*** Some traps do, you know, because of the nature of their operating principle. No steam ever gets to the Armstrong trap orifice. The valve is always water sealed.

2. ***A steam trap should vent "air" as fast as it accumulates***—otherwise temperatures are reduced and corrosion is a problem. The Armstrong trap handles air very nicely. The vent in the bucket permits air to accumulate in the top of the trap, from where it is discharged when the trap opens. For extreme conditions like draining paper machine dryers, some jacketed kettles and certain other units, the vent is sized larger for the job. And, for handling big volumes of air during warm-up, a bucket with an auxiliary thermic vent really speeds up heating.

3. ***A steam trap should discharge condensate at steam temperature*** if you want to get maximum efficiency from the unit drained. And most people certainly do. If you have to wait for the condensate to cool, it's almost impossible to maintain maximum temperatures and prevent air build-up. You guessed it—the Armstrong trap opens for water, without dependence on temperature.



Trap closed. Steam has floated inverted bucket; valve is held tightly closed by system pressure. Air entering trap passes through bucket vent and accumulates at top of trap.

Trap open. Condensate entering trap has caused bucket to lose buoyancy. Weight of bucket times leverage pulls valve open. Air is discharged along with condensate.

4. ***A steam trap should be suitable for any return system.*** The Armstrong trap works just the same whether discharging to atmosphere, back pressure or vacuum. It has been conclusively proved that flash steam resulting from use of a bucket trap does not cause a problem in vacuum return systems. The flash condenses rapidly. It's the leaky traps that cause the headaches.

5. ***A steam trap should not be a "prima donna".*** Some kinds of traps take an awful lot of care and coddling. The Armstrong trap is a rough and ready type with a hardened chrome steel constitution (valve and seat, to be exact). It cleans itself of ordinary dirt and scale without choking up. Its 18-8 stainless parts stave off rust and corrosion. It resists wire-drawing and wear remarkably well. In fact, it stays on the job longer with less attention than any trap ever produced. Unless you live in Siberia, you can probably find a user around the corner who will tell you so from experience.

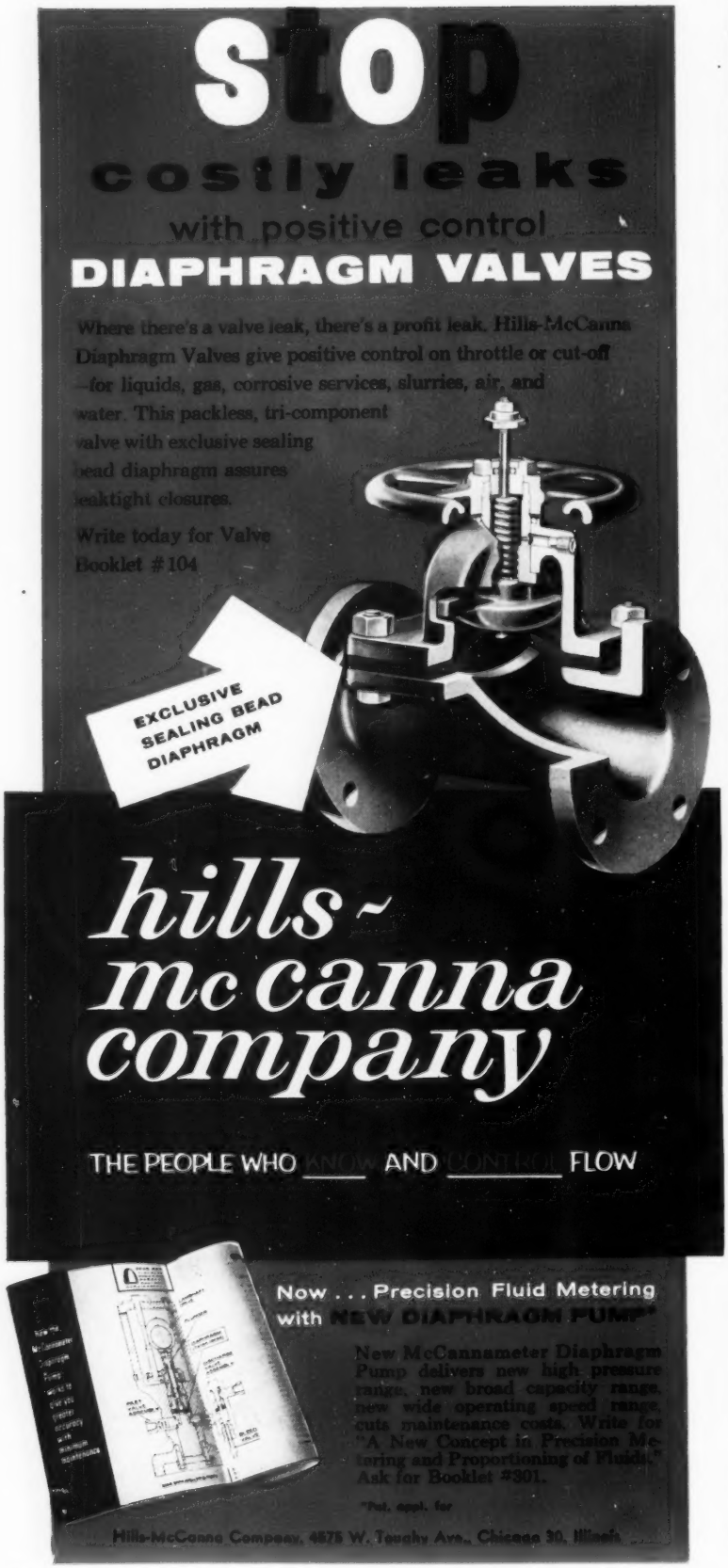
6. ***A trap should not be an "orphan".*** With Armstrong traps you can *always* get prompt service and parts from nearby Factory Representatives and stocking distributors as well as from the factory.

7. ***A trap should have a guarantee.*** The Armstrong trap is unconditionally guaranteed to give you *complete satisfaction* (as to doing its job, that is). If it doesn't, you can get your money back.

If you'd like to buy some of these excellent steam traps, call your local Armstrong Representative or write **Armstrong Machine Works, 9652 Maple St., Three Rivers, Michigan.**

ASK FOR the 44-page Steam Trap Book, free on request without obligation.

ARMSTRONG STEAM TRAPS



poration are admitted to membership, the entrance fee for all except one will be waived.

The Policy Committee also tentatively agreed upon the following statements of policy:

¶ An engineer associated as a partner with an architect is eligible for membership only when he fully controls engineering policy and activities of the firm.

¶ An applicant for membership shall have been established in private practice not less than three years, unless in the unanimous opinion of the Membership Committee the applicant has demonstrated good reputation and substantial stability.

¶ Land surveyors, or civil engineers engaged primarily in subdivision development will not be solicited for membership at the present time.

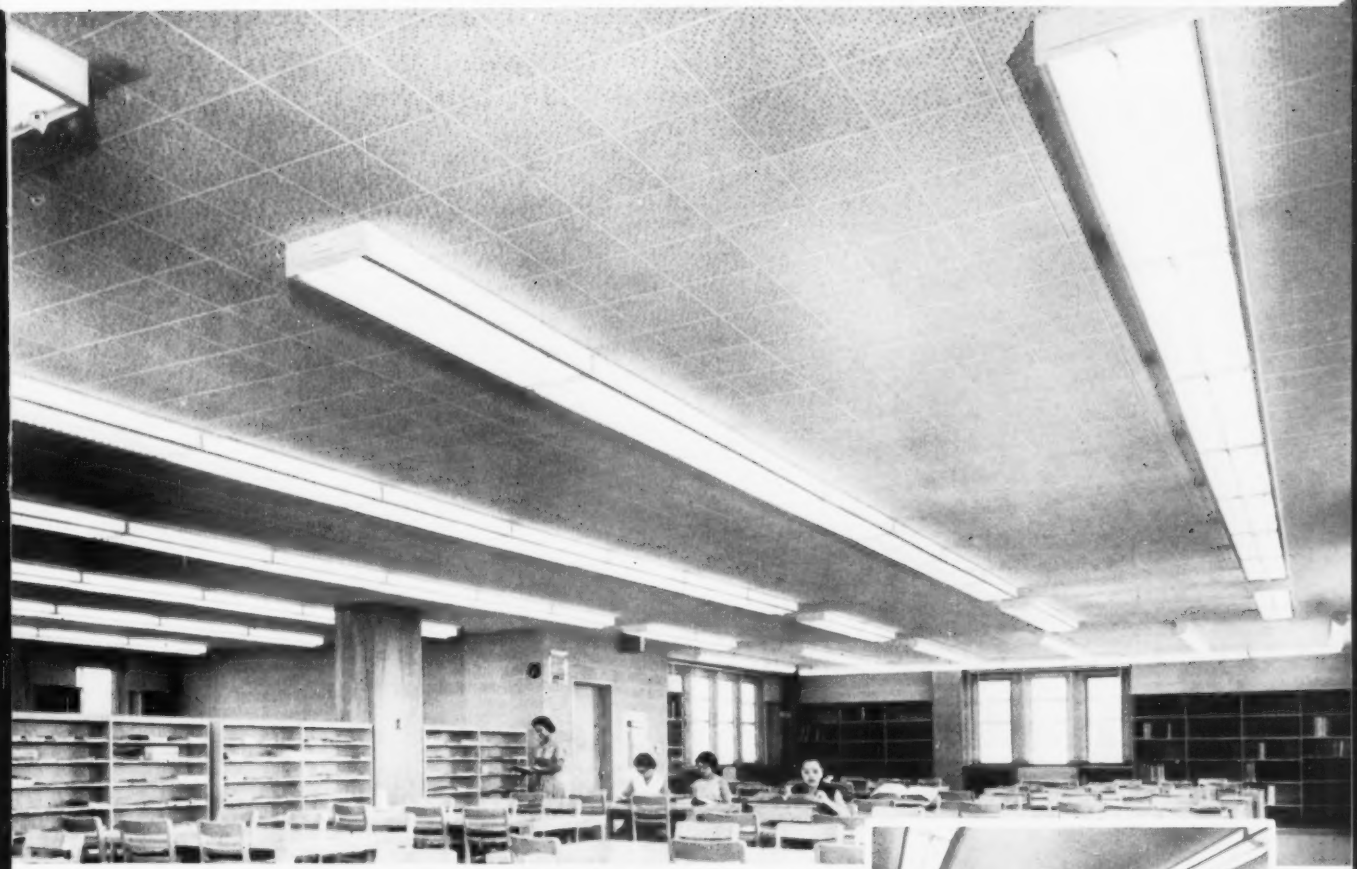
¶ It is the policy of the Association not to accept as a member any officer of a corporation unless such corporation has a separate engineering organization and the engineering officer has full control of the engineering policy and activity of that corporation.

¶ That, for the present, membership will not be solicited from engineers who are affiliated with an engineering organization that is associated with a firm or is a subsidiary of a corporation engaged in construction activities.

It also was the opinion of the committee that where a firm is engaged in both engineering and surveying, and engineering work predominates, the principals of the firm are eligible for membership. Testing laboratory engineers were considered ineligible for membership.

It was recommended by the committee that delegates to CEC should be appointed on a two-year basis. The two delegates should have staggered terms or the executive secretary should serve as the second delegate or "advisor to delegates" to maintain continuity of policy.

The committee urged the Association to set up a special com-



Sylvania Mohawk Fixtures get permanent library duty in new College of Education Building, University of Tennessee, Knoxville, Tenn. Architects and engineers on job: Barber & McMurry, Knoxville.

Sylvania Mohawk Fixtures . . .

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In providing more than two dozen different lighting design combinations, with only a few standardized components, the Mohawk Series is one of the most complete fixture lines of its type today. It gives you a custom approach to lighting . . . choice of 2 standard widths, 2-, 4-, or 8-foot lengths, and 5 different types of shielding.

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mittee on Practice and Ethics, the scope of which would include: competitive bidding, advertising, and engineering work done by civil service and college faculty members. Standards set by the various technical societies also should be reviewed by this special committee. The Committee recommended that the California Association should carry on a limited public relations program, allowing CEC to develop its national program.

Competitive Bidding

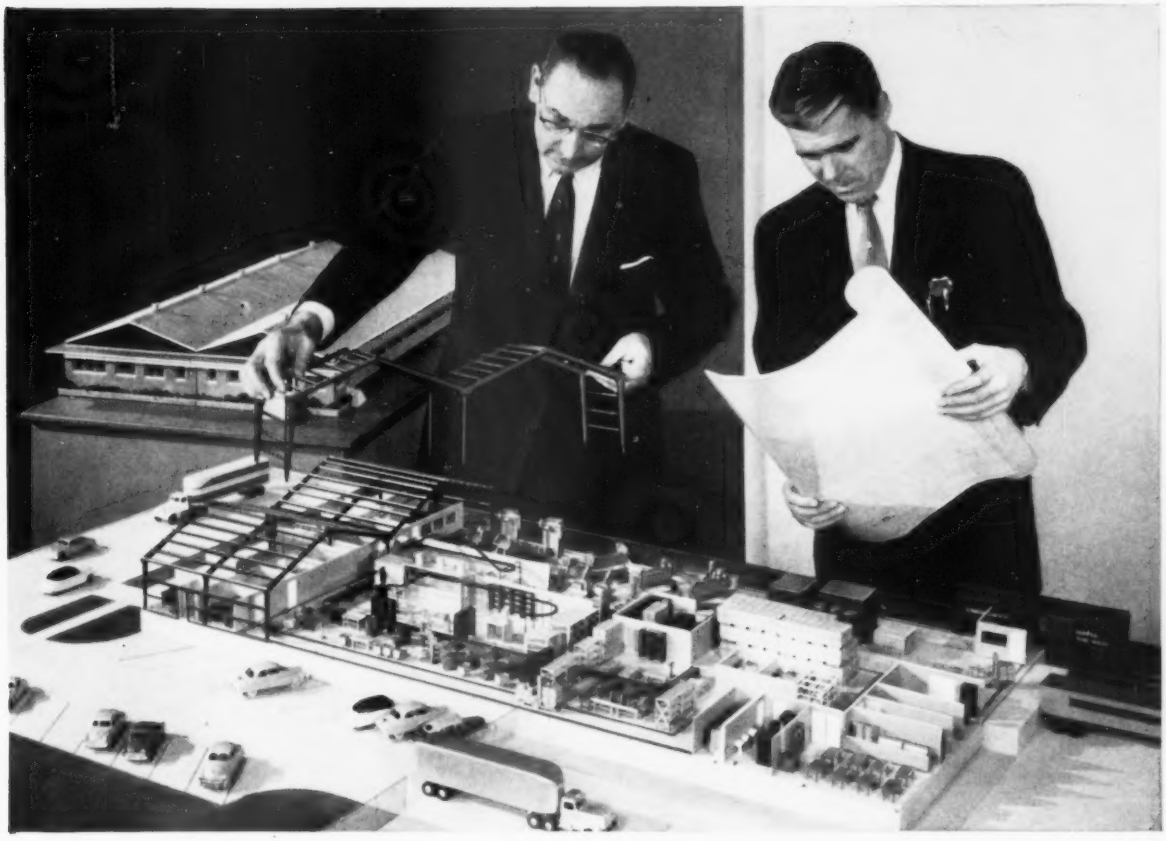
President Westcott opened the discussion on the "Suggested Rule of Procedure for Answering Inquiries Regarding Proposals for Engineering Services." The suggested rule is:

"It shall be considered unethical practice for any member of the Consulting Engineers Association of California to submit a quotation for engineering services which is solicited by mail or in any event where he has reason to believe that other engineers are being requested to submit a quotation for the same services.

"Elements considered to constitute a quotation include: total fee; fixed fee; percentage fee, other than by reference to an established and recognized fee schedule; man-hours; hourly rates; multiplying factor for hourly rates; or any combination of such elements.

"Replies to such solicitations shall be limited to listing technical qualifications and availability."

President Westcott cited the example of a large aircraft manufacturing firm which sent out a letter seeking bids for engineering. The company official responsible for sending out the letter asking for bids was contacted, and the proper role of the consulting engineer was explained to him. In spite of these explanations he did not offer to change the practice. In fact, he said that he believed in competitive bidding for his own personal medical services and had called for and gotten bids



Why engineers are choosing pre-engineered Butler buildings

Engineers are discovering that precision-made, pre-engineered Butler buildings provide a completely standardized, yet flexible system of building. They have discovered that this system enables them to substantially reduce routine engineering time. Being freed from detail work, they have been able to concentrate on planning the over-all facility. Results—they have been able to provide more efficient facilities at lower cost . . . in far less time than traditional construction methods would permit.

The clear-span construction permits wide flexibility in laying out production, materials-storage and finished-stock areas. The truss-free, gable roof not only provides clear, overhead space for the installation of utilities and materials-handling systems, but also ventilates naturally. With the installation of Butler plastic, translucent Lite*Panls, engineers can take advantage of natural daylight for much of their lighting requirements. The weather-tight construction plus vapor-sealed insulation produces a building that is easy and economical to heat or cool, because there is less heat loss than in a traditional masonry building.

For further information on the Butler Building System and how it can help you build well . . . quickly and at low cost, a wide variety of industrial facilities, phone your Butler Builder. He's listed in the Yellow Pages of your phone book under "Buildings" or "Steel Buildings" or write direct.

see our catalog in Sweet's or write for copy

BUTLER STEEL PRODUCTS

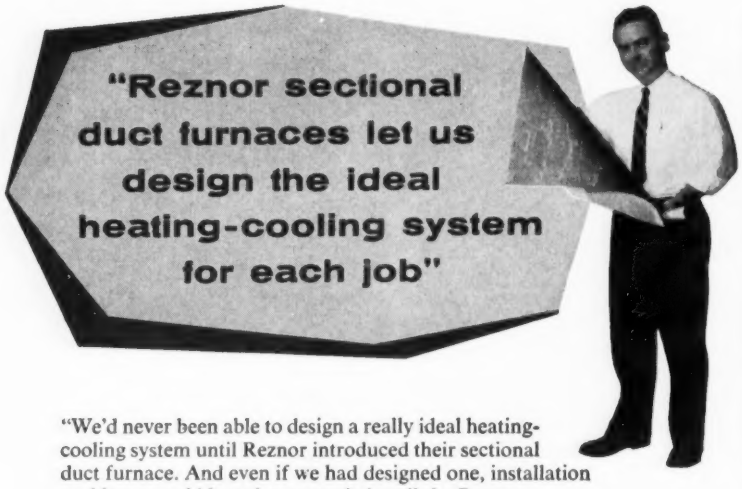
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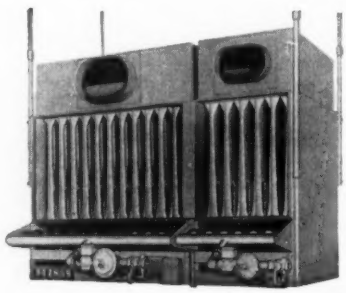
"We'd never been able to design a really ideal heating-cooling system until Reznor introduced their sectional duct furnace. And even if we had designed one, installation problems would have been stymied until the Reznor sectional duct furnace came along.

"Sectional assembly eliminates the installation problems which formerly prevented the use of large capacity custom-engineered duct systems. With the new Reznor DS sectional duct furnaces, we can specify system capacities of two million BTU or more knowing that they can be assembled on the job from sections weighing no more than 315 pounds.

"Reznor sectional duct furnaces free us completely from packaged heating equipment which isn't exactly right for any one job because it has to be almost right for so many jobs. Now we start with a Reznor duct furnace, which is simply nothing more than a compact, highly efficient gas-fired heat exchanger with a complete set of combustion controls. To this we add the components for air moving, cooling, cleaning, and humidifying selected to meet exact job requirements. For our client it means greater efficiency, greater comfort, and lower cost.

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from several doctors prior to his last operation.

A number of engineers cited examples where competitive bidding practices had been defeated by education and refusal to submit a competitive bid. Some definite advances have been made in correcting the practice, and both the Navy and the Air Force have adopted new rules in which qualifications and availability and not fees are governing the selection of consulting engineers.

The convention approved the rule of procedure to be followed by consulting engineers for answering inquiries regarding proposals for engineering services.

Ethics

L. T. Evans commented on the article, "I Gave Up Ethics to Eat," which was published in the December issue of CONSULTING ENGINEER. He said that the article served a good purpose in bringing to light conditions involving competitive bidding and dealings through commission agents, and the laxity of the Founder Societies in dealing with the problem. Hunter Hughes, editor of CONSULTING ENGINEER, was asked to identify the anonymous author and his state and suggest solutions for meeting such situations. Hughes refused to reveal identities or locations and said that he felt nothing would be gained by reopening the old cases cited. Instead, all societies and associations interested in professional ethics should act with more courage when cases of unethical conduct are brought before them. He said that ASCE is the only group that has ever taken firm action in an ethics case — and even they had backed up later by relaxing their code of ethics.

Engineer Recognition

At the luncheon the subject of what might be done to gain a better understanding and recognition of the consulting engineer and his services was discussed. Several approaches were suggest-

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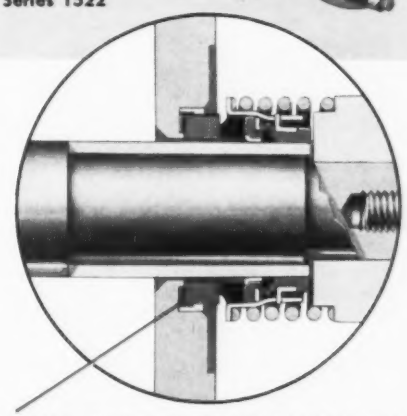
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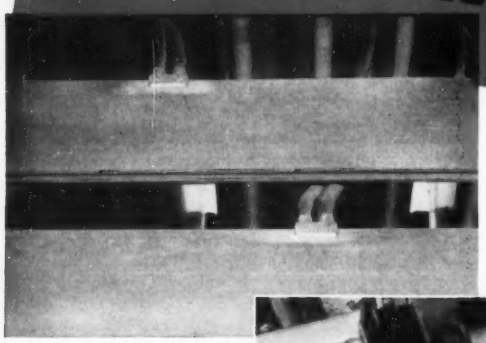
BELL & GOSSETT CO., Dept. FE-70, Morton Grove, Ill.
Please send a copy of the B&G Stock Pump Catalog CSP-257A.

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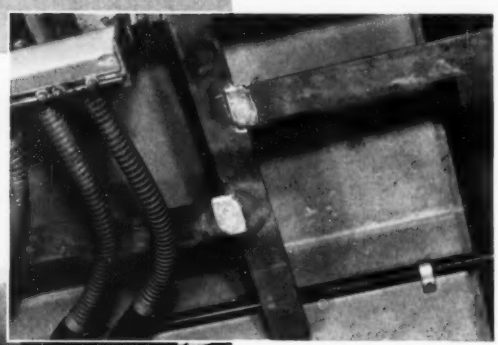
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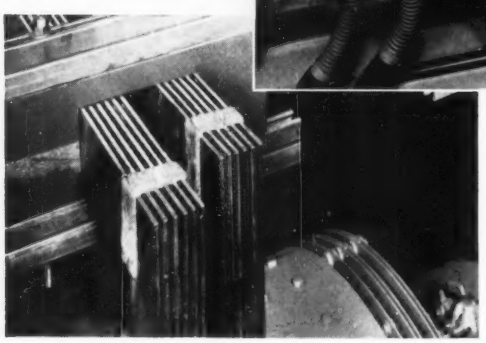
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ed — advertising; firm brochures explaining the qualifications of the engineer and types of service, which could be expanded to include something on the functions of the profession in general; and the publication of a small magazine to be distributed nationally to prospective clients. The magazine might include a 16-page section of national interest with a 4-page section devoted to local interests in each state.

It also was suggested that engineers in private practice might, to a great extent, be differentiated from registered engineers in industry, government, or education by laws requiring that all engineers offering their services to the public be required to carry errors and omissions insurance. This evoked considerable discussion — for and against the idea.

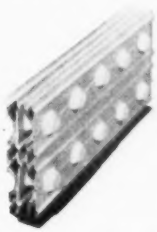
Vernon A. Smoots, chairman of the trustees for the CEAC health and hospital insurance program, presented his report on the insurance plan, which became effective April 1, 1957. The total enrollment at the end of 1957 was 43 employer firms, 362 employees, and 238 dependents. If the present low claims' level is continued, refunds are anticipated from the insurance company. Coverage also is now available for on-job sickness and accident insurance.

T. R. Simonson outlined the report of the Construction Liaison Committee. The committee consists of representatives of AIA, Associated Plumbing Contractors, Sheet Metal Contractors Association, Electrical Contractors Association, and CEAC. A set of "Suggested Standards" was divided into three groups. "Standards of Design" incorporates simple requirements for drawings and specifications to be considered a minimum basis for satisfactory electrical and mechanical contract documents. "Standards for Construction" will include rules for orderly procedure on the part of electrical and mechanical contractors. "Suggested Division of Work between Specification Sections"



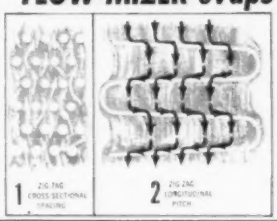
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1 New Plastic Pak weighs 90% Less in FLOW-MIZER TOWERS!



The new all-plastic Acme-Pak makes Acme towers lighter, more economical than ever. In an average unit (100-ton), the entire pack now weighs only 180 lbs as against 2300 lbs for a comparable steel pack! This means real savings on installations and on freight. Better still, it can never rot nor rust . . . . is cleaned more quickly, less frequently. Total savings are two-fold: lower installed cost, lower maintenance cost.

2 Zig-Zag coil spacing means greater capacity, less HP in NEW FLOW-MIZER evaps



Acme's zig-zag spacing improves coil efficiency in two ways. (1) By staggering the tubes, air and spray water travel a longer zig-zag path, effecting greater turbulence and better heat transfer. (2) By sloping the tubes longitudinally, spray water remains in longer contact with each tube. Also, the condensed refrigerant drains more rapidly. The result is more efficient evaporation . . . which means more capacity in less space with less blower hp.

3 Twice as much surface protection

Acme's hot-dip galvanizing *after* fabrication deposits twice the thickness of zinc that ordinary electroplating does. This double protection against rust leaves no surface exposed. Units never need painting.

4 Easily serviced external sump

On both cooling towers and evaps, Acme's external sump provides quick easy access. Sediment screen, float valve, and water treatment facilities are reached by lifting the cover.

5 Full access to coil or pak

For fast, easy maintenance, the new Acme units offer convenient access to nozzles, eliminators, pack or coil by removal of full-width panels front and rear. Sliding doors provided for quick inspection.

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After final assembly, All Acme blower units are now electronically balanced to assure quiet, smooth operation at all times . . . less wear on blower bearings . . . greater efficiency . . . longer trouble-free service.

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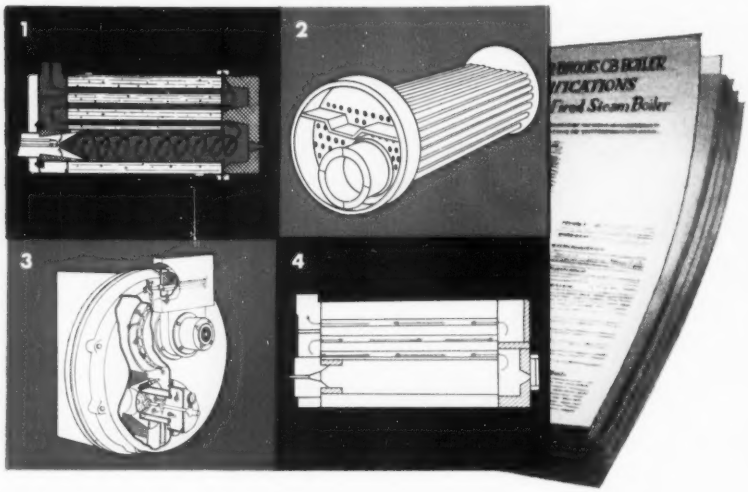
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These design standards are the basis for peak operating efficiency and greater safety. What's more, Cleaver-Brooks boilers save installation time and money. These fully packaged boilers arrive fully assembled, ready to install. Each boiler is fully fire-tested at the factory under load, tuned to peak economy. Starting service and on-the-job operator training by authorized field engineers further decrease overall costs, promote customer satisfaction.

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calls attention to items often either omitted from specifications or included simultaneously in more than one section.

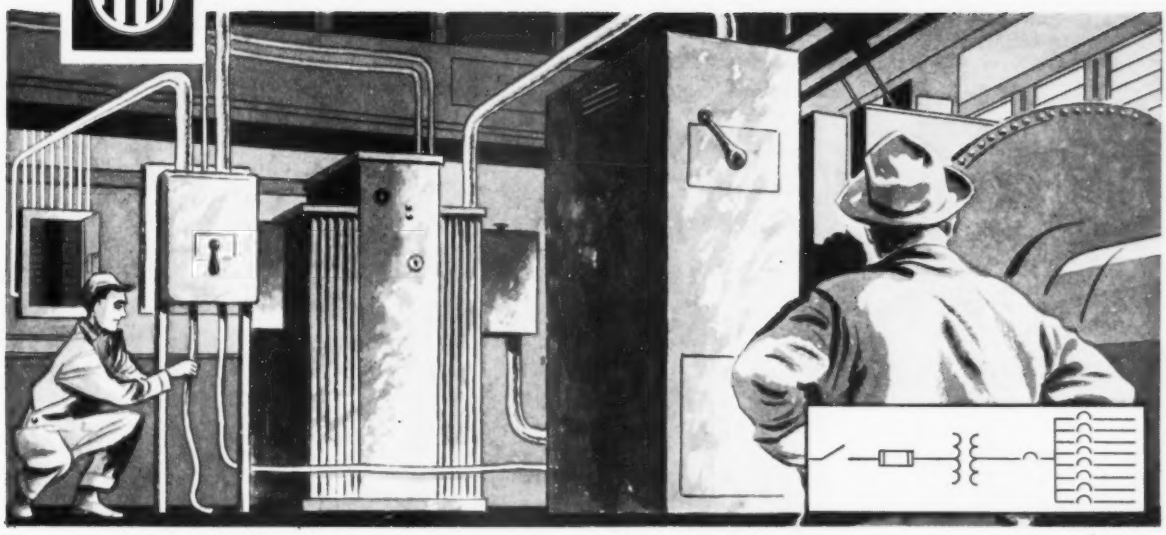
R. D. Spencer reported on the activities of the Architects and Engineers Conference Committee of California. Subjects discussed during the four quarterly meetings in 1957 included: legislation affecting architects and engineers; union label on plans; structural engineer's signature on plans; lobbying by state employees; architects' service contracts on work for the Los Angeles City School District; time taken by State Division of Architecture to check plans; electrical and mechanical inspection on school work; building code problems; proposed reorganization of Department of Professional and Vocational Standards; uniform contract of American Institute of Architects; competitive bidding; and International Building Officials Conference.

Fee Schedules

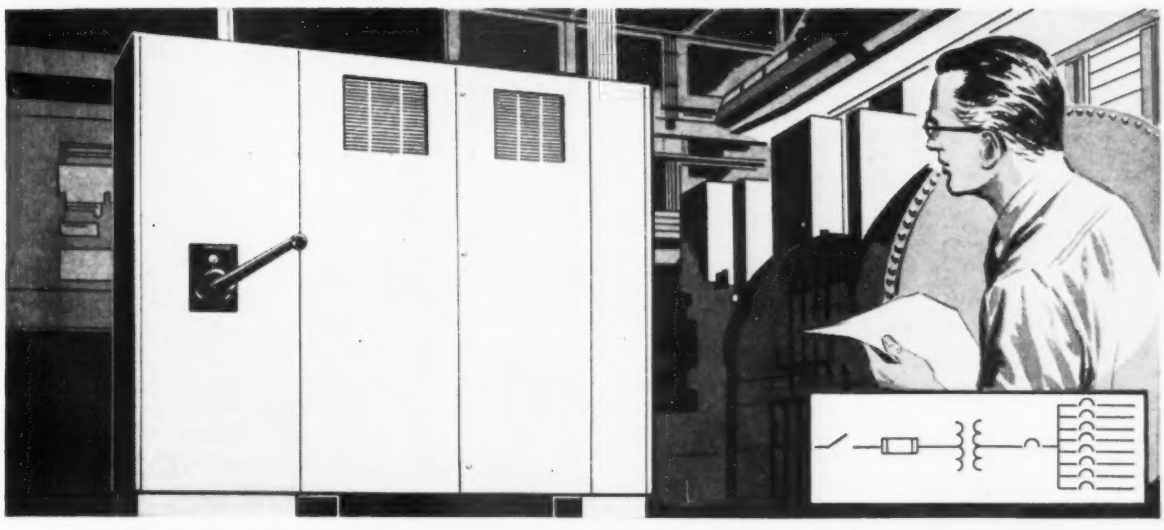
Jos. Sheffet, chairman, presented the report of the Engineering Fees Committee. Part I of the report dealt with the efforts of the committee to produce a statewide fee schedule. This objective is difficult to attain as it includes so many different fields of engineering practice in many differing localities. In the field of civil engineering, the committee endorses the ASCE fee curve. The Civil Engineers and Land Surveyors Associations in the State have a "Recommended Minimum Fee Schedule" which also is endorsed. The committee is cooperating with the Structural Engineers Association of California to establish standards for fees in the field of structural engineering. Fee problems of electrical and mechanical engineers in the building field parallel those of the structural engineers, and it is expected that a solution will be found in the near future.

Part II of the report covered the Los Angeles City School Dis-

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EVERY ENGINEER will want a copy of this NEW BULLETIN



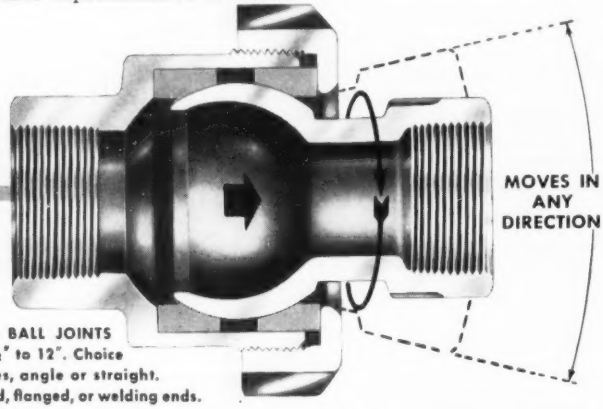
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2. Virtually no deterioration. Able to stay in service for years without repairs or maintenance. No lubrication.
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trict situation. Although standard subcontracts covering all of the consulting engineering services required by the architects were prepared and distributed to all engineering consultants doing district work, the architects do not wish to clothe these contracts with any official status.

Discussion revealed that part of the fee trouble in school work resulted from the failure of the architects to get a basic fee high enough for adequate compensation of engineering subcontracts.

Glenn Galch, president, California Council, AIA, asked the Association for its cooperation in establishing better standards for mechanical and electrical inspection of structures and for help in training inspectors. A committee is to be appointed to study the problem and present suggestions for its solution.

T. R. Simonson outlined the function of the Building Research Institute in building research and technology. Membership includes architects, engineers, manufacturers, contractors, technical and professional societies, and colleges and universities.

Newly elected President Harold P. King, taking over the gavel from outgoing President Ralph Westcott, asked for suggestions for the next annual meeting location. The meeting will be in the northern section of the state. It was suggested that an extra day be added to the next meeting to take care of the large agenda.

New Officers

Officers elected for the ensuing year are: president, Harold P. King, Los Angeles; vice president, John A. Blume, San Francisco; secretary-treasurer, Arch D. McDougald, Fresno. Directors are John J. Gould, San Francisco; Sheldon W. Swickard, Los Angeles; Richard Kennedy, San Francisco; Ralph Westcott, Los Angeles; Robert B. Earl, San Francisco; David L. Narver, Jr., Los Angeles; and A. A. Sauer, Sacramento. ▲▲

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Heart of the system is the Yarway Remote Liquid Level Indicator that gives instant, accurate readings because the mechanism is operated by the boiler water or other liquid itself. The pointer mechanism is never under pressure. Clear, "wide vision" face permits easy readings from any angle.

The Yarway Indicator conforms with A.S.M.E. Boiler Code Committee ruling (Case #1155) permitting two independent remote level indicators of compensated manometric type to replace one of two required gage glasses for boiler pressures 900 psi and above.

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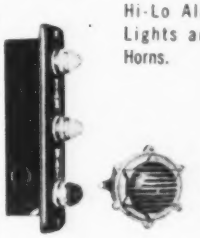
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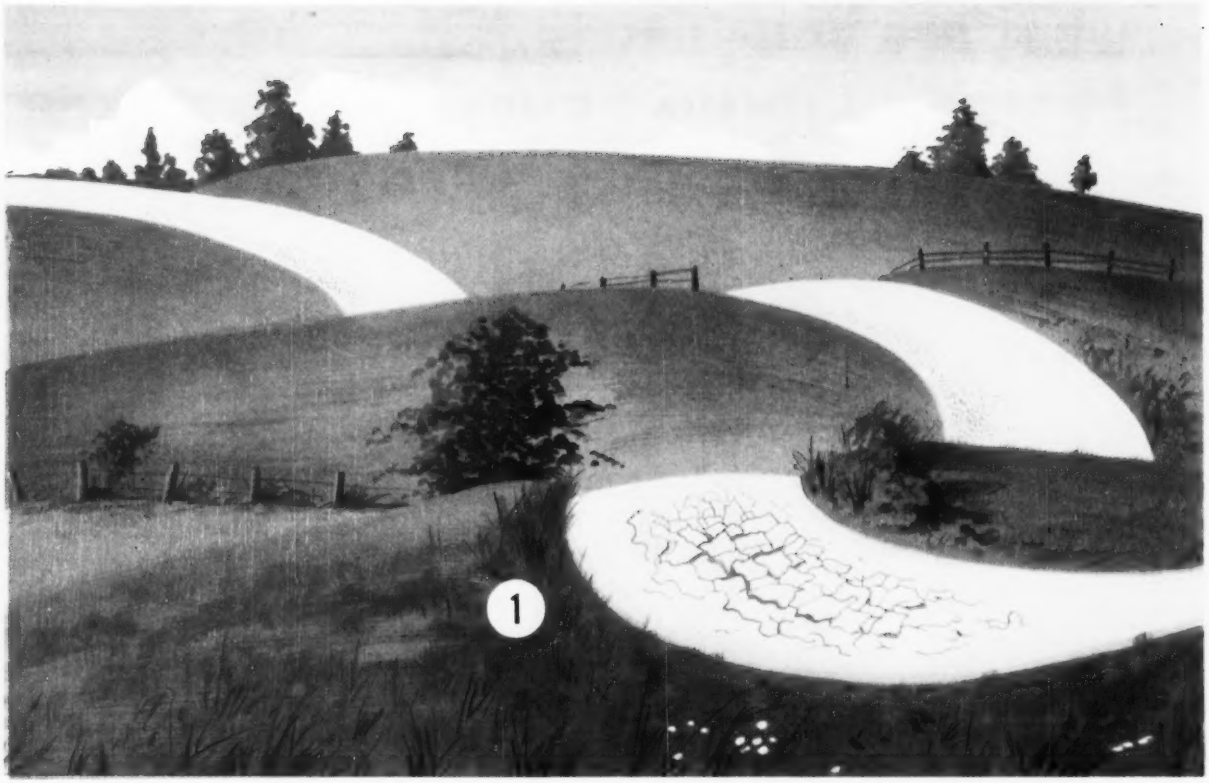
Hi-Lo Alarms. Lights and/or Horns.

RECORDERS

To provide permanent 24-hour record of liquid levels.



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TYPICAL PAVEMENT PROBLEMS: 1—FAILURE OF FLEXIBLE PAVEMENT THROUGH LOSS OF

Perspective Data on Paving Design

CE exclusive

ENGINEERING TEXTS and data books contain a wealth of technical material dealing with the design of highways and streets. This is readily available to any engineer who finds himself called upon for highway projects. But more than this is needed. The engineer who does only an occasional highway project may find that he needs more of what I call "perspective data."

Perspective data can be general or specific, quantitative or qualitative — but it is never absolute. For example, the general knowledge that timber floats, or even the more specific knowledge that white pine floats higher in the water than white oak, is perspective data. This can be contrasted with the absolute knowledge that the specific gravity of white pine is 0.43 while the specific gravity of white oak is 0.77.

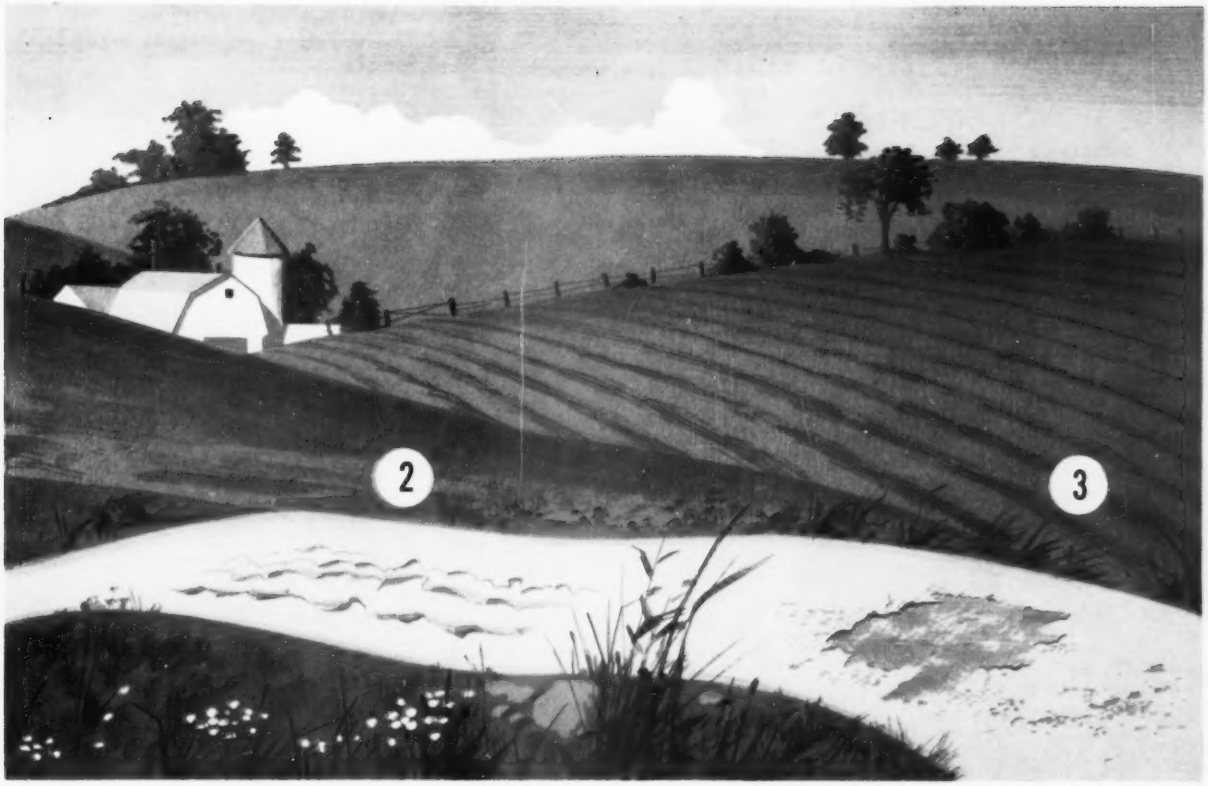
Perspective data, however, can involve specific figures. If we say that a particular type of building will cost $14.00 per square foot of floor area to build, we are dealing in perspective data rather than in absolute fact. Nevertheless, the figure is an important one to anyone considering the building of such a structure.

Engineers Prefer Absolute Data

Unfortunately, most engineers hesitate to deal in perspective data when it has to do with engineering design. We do not mind giving estimates on costs or even on quantities such as cut or fill, but when we start to design, we hesitate and usually refuse to speak unless we can furnish accurate and absolute technical data from handbooks or from original calculations.

The result is that almost every engineer has to collect his own perspective data through his years of practice. This is unfortunate and unnecessary, and I am willing to stick my neck out a little with the understanding that it might be chopped off.

This information I offer is not for the Ages. There is no need to grave it in stone. Next year these data could be wrong because of improvements in materials or the development of new materials. We can



DUCTILITY. 2—LOCAL BREAKAGE CAUSED BY SUBGRADE FAILURE. 3—SURFACE SPALLING.



ELWYN E. SEELYE, Seelye Stevenson Value & Knecht

Elwyn E. Seelye, senior partner of Seelye Stevenson Value & Knecht, is a graduate of Cornell University, having received his C.E. degree in 1904. He is registered in 12 states. Mr. Seelye is the author of the three-volume data book for civil engineers and the author of Foundations. He is a member of the American Society of Civil Engineers, the American Institute of Consulting Engineers, the New York Association of Consulting Engineers, and a number of other technical and civic groups. Mr. Seelye has been in independent practice since 1912, his firm specializing in structural, industrial, and general civil engineering.

be quite sure that the dollar and cents figures will be off because it is not likely that next year's dollar will have the same value as the dollar today. These figures apply, therefore, only to the early spring of 1958, and they are perspective data only.

Within those limitations, they should be useful.

I have shown in Table 1 the thicknesses we have found proper for flexible pavement placed over several types of subgrade soil and for three different wheel loads. Table 2 gives the same data for thicknesses of rigid pavement. We have found these figures correct for roadways properly drained and designed to avoid frost damage.

Then, there is the important question of what pavement of the thicknesses shown in Tables 1 and 2 will cost. We have found that pavement will vary in cost according to the type of subgrade. The higher figures here are for soft clay, the lower for gravel.

Wheel Loading	Pavement Cost Per Yard	
Tons	Flexible	Rigid
8	$3.30 — $2.25	$4.00 — $3.50
6	2.90 — 2.00	3.50 — 3.10
4	2.25 — 1.50	2.90 — 2.50

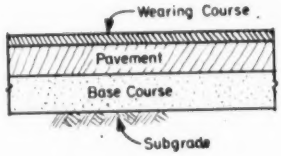
These figures do not take into account the cost of grading nor do they include the cost of providing nonfrost-heaving subgrade.

Life Expectancy

Now that we have some perspective concerning thickness and cost, what about expected life? Here is a field in which we must present only the most general data. The life of a rigid pavement depends

TABLE 1—YARDSTICK FOR PAVEMENT THICKNESS

Subgrade Type of Soil	Flexible Pavement Thicknesses, Inches 8-Ton Wheel Load	6-Ton Wheel Load	4-Ton Wheel Load
Soft Clay	21.0	18.0	15.5
Sandy Clay	10.5	9.0	8.0
Gravel & Clay	8.0	6.5	5.5
Gravel	7.5	5.5	4.5



Flexible Pavement



CONCRETE PAVING HAS LIFE OF ABOUT 30-40 YEARS. THIS OLD PAVEMENT IS SPALLING.

on the type of aggregate, the control of grading and placing, and the intensity and type of traffic over the finished roadway. For states above the Mason-Dixon Line, if these factors are adverse the concrete pavement will last 15 years. If these factors are favorable the road will last 30-40 years.

Concrete roads are not useless, however, even then. After surface breakdown they have a high salvage value, for it is quite easy to resurface them with a good bituminous topping. If done by a good contractor, this resurfacing can give 15 to 20 more years of life. We specify a bituminous topping 2½-in. thick made up of a 1¼-in. surface of hot asphalt over a 1¼-in. binder. The cost of this resurfacing, including the preparation of the worn concrete, should run about $1.50 per yard. This gives an amazingly smooth surface, pleasant to ride on.

The thinner, temporary coatings have a much shorter life and the defects in the concrete soon show through. The road may look rather good, but the ride is far from comfortable.

The life of a flexible pavement is shorter. The average is about 20 years as compared to 30 years for concrete. This is as it should be, for its cost is less. It is necessary, however, to recognize that at the end of its life, flexible pavement has a low salvage value. And after the first 10 years the pavement may not be in the very best condition because of the forming of birdpaths or of localized breaking.

Repairs to Flexible Pavement

Repairs to flexible pavement are difficult and are apt to have a short life of about five years. An emulsion treatment filled with sand could be good for about two years and cost about 7 cents per square yard. Bad spots can be repaired by using a graded bituminous concrete, spread with a skid or movable screen. This type of repair costs 25 cents per square yard and has a life expectancy of about three years. Riding qualities are poor, and a complete reconstruction is to be preferred.

Armor coat treatments are satisfactory for light traffic only.

Flexible pavements have some advantages over concrete for special conditions. Where settlements are expected (over swails, for example, that have

OXIDATION AND OVERHEATING CAUSES THIS TYPE OF FAILURE IN FLEXIBLE PAVEMENTS.

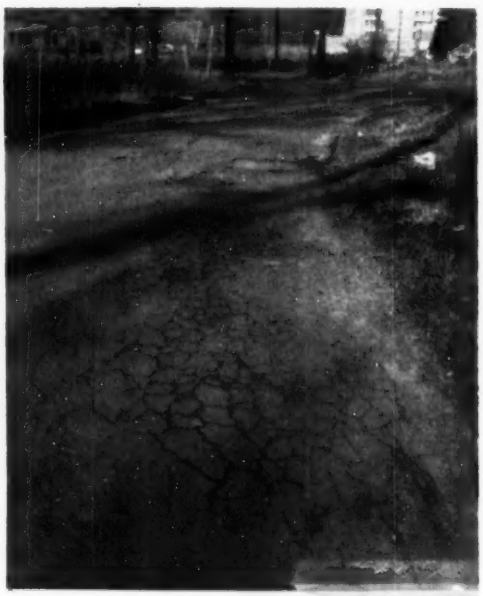
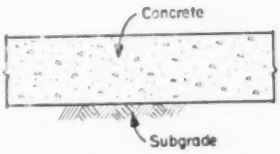


TABLE 2—YARDSTICK FOR PAVEMENT THICKNESS

Subgrade Type of Soil	Rigid Pavement Thicknesses, Inches 8-Ton Wheel Load	6-Ton Wheel Load	4-Ton Wheel Load
Soft Clay	8.50	7.50	6.00
Sandy Clay	8.25	7.25	5.75
Gravel & Clay	8.00	7.00	5.50
Gravel	7.50	6.50	5.25



Rigid Pavement

not been dug out and refilled), flexible pavement will stand up longer without cracking. Flexible pavement also is more suitable for secondary roads because of its low first cost and its adaptability to settlement.

City Streets

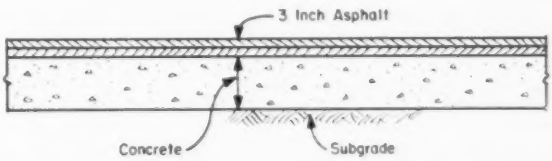
For heavily trafficked city streets, we have found the best answer to be a composite construction made up of a concrete pavement covered with a 1½-in. asphaltic concrete binder course and a 1½-in. sheet asphalt wearing surface. This costs about $5.00 per square yard. Not only does this give an excellent, quiet riding surface, but it can be cut into easily and readily resurfaced.

Warning Concerning Perspective

It is important to remember that these comments have to do with perspective data only. None of these can take the place of detailed engineering calculations for special conditions, and certainly, they do not replace soil mechanics studies where these seem essential to the job. This is common sense engineering — valuable, but applicable only to the routine project. ▲▲



BITUMINOUS LAYER OVER EXISTING RIGID PAVEMENT PROVIDES GOOD ROAD SURFACE.



REPAIR TO CITY STREET USING TWO, 1½-IN. COURSES MIGHT COST $5.00 PER SQUARE YARD.



BITUMINOUS SEAL COAT IS CHEAP BUT HAS LIFE OF ONLY 2 YEARS.



FLEXIBLE PAVEMENT WILL BREAK UP LOCALLY IF THE SUBGRADE FAILS, BUT IT HAS 20 YEAR LIFE IF PROPERLY LAID.

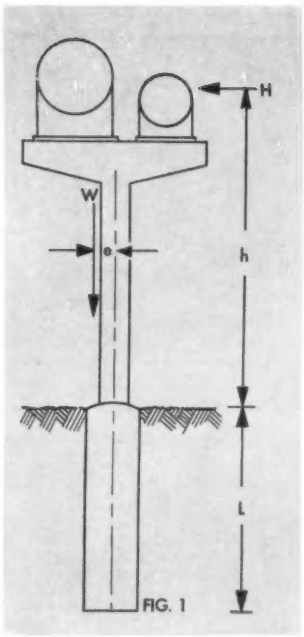


FIG. 1

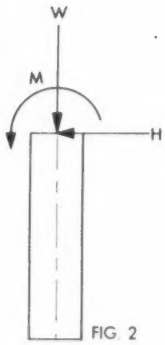


FIG. 2

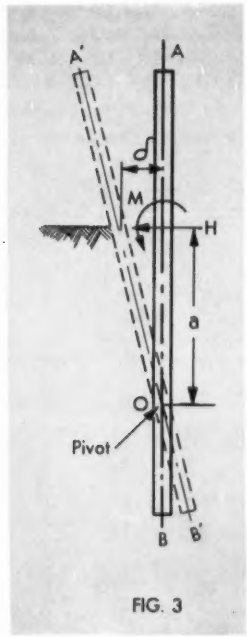


FIG. 3

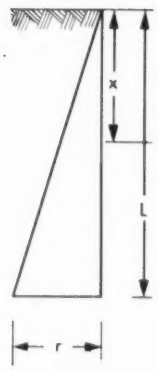


FIG. 4

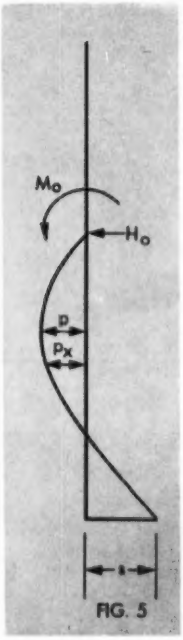


FIG. 5

Design Criteria for Embedment of Piers



E. CZERNIAK, The Fluor Corporation, Ltd.

E. Czerniak, design engineering supervisor at The Fluor Corporation, Ltd., holds both a B.S. and M.S. in civil engineering from the School of Engineering, Columbia University. Following his graduation, in 1950, he worked in the fields of civil and structural engineering for several companies on the east coast. In 1953 he joined Fluor, as a design engineer, working on major projects in the petroleum and chemical fields. In 1955 he was appointed to his present position. Among the projects on which he supervised the structural design engineering were the $30 million plant Fluor designed, engineered, and constructed for the Texas Butadiene & Chemical Corporation, at Channelview, Texas, and the $20 million installation for the Odessa Butadiene Company, at Odessa, Texas. Czerniak is a registered civil engineer in the State of California, and is an Associate Member of the ASCE.

CE exclusive

EVERY STRUCTURE standing above ground is affected by lateral forces which, like vertical loads, must be resisted at the ground, and it often becomes desirable to depend on the resistance of the earth to guard against a lateral displacement of a partially embedded pier. The determination of this earth pressure resistance to lateral loading has long been a matter of conjecture, but the popularity of machine-drilled footings has increased the consulting engineer's interest in adequate design criteria that will yield safe and economical results.

The structural function of an embedded pier is to resist vertical loads, lateral loads, and overturning moments, the successful accomplishment of which depends on sufficient embedment and capacity to sustain the axial loads, shears, and bending moments.

Vertical loads are resisted either by end bearing or through friction, depending on the soil conditions.

In resisting lateral loads and moments, the pier is assumed, for the purpose of analysis, to be absolutely rigid with respect to the surrounding soil. The pier thus pivots about a point somewhere along its length as resistance to the applied loading is being developed.

It is argued correctly that absolute rigidity does not exist, and bending stresses always are associated with deflections of the pier axis. However, the effect of such deflections on the soil pressure decreases as the rigidity of the pile increases. Also, because of the

unavoidable uncertainties involved in the fundamental assumptions and the numerical values of the soil constants, simplicity is deemed to be of the utmost importance in obtaining a practical solution. A pier, or a short pile, whose embedded depth does not exceed ten times its least lateral dimension will be considered sufficiently rigid so that the depth of embedment and maximum bending moment may be derived by the ordinary rules of statics.

Fig. 1 shows a refinery installation, in which drilled piles have been used as the foundation unit to support elevated horizontal vessels, heat exchangers, piping, and other equipment. The resultant vertical load W acts at a distance e from the center line of the pile, and the lateral load H acts at a distance h above the ground. The effect of the original loading, then, may be considered as equal to an axial load W, a horizontal load H, and a moment M equal to We + Hh (Fig. 2). In the analysis that follows, only the lateral loading and moment will be considered.

Let AB, the axis of the pile, be originally vertical. Under the action of the applied loads (Fig. 3), the pile will pivot about point O until the soil in front of A'O and in back of OB' becomes sufficiently compressed to maintain equilibrium. The soil resistance to lateral deformation usually is expressed as a function of depth, and in order to simplify the analysis, it is further assumed that the relation is linear (Fig. 4), that is, the available resistance is directly

TABLE 1 — RECOMMENDED LATERAL SOIL PRESSURE
pounds per sq ft per foot depth

Class of Material	*Value*
Rock in natural beds — limited by the stress in the pile	
Medium hard caliche	500
Fine caliche with sand layers	400
Compact well graded gravel	400
Hard dense clay	400
Compact coarse sand	350
Compact coarse & fine sand	300
Medium stiff clay	300
Compact fine sand	250
Ordinary silt	200
Sandy clay	200
Adobe	200
Compact inorganic sand & silt mixtures	200
Soft clay	100
Loose organic sand & silt mixtures; muck or bay mud	0

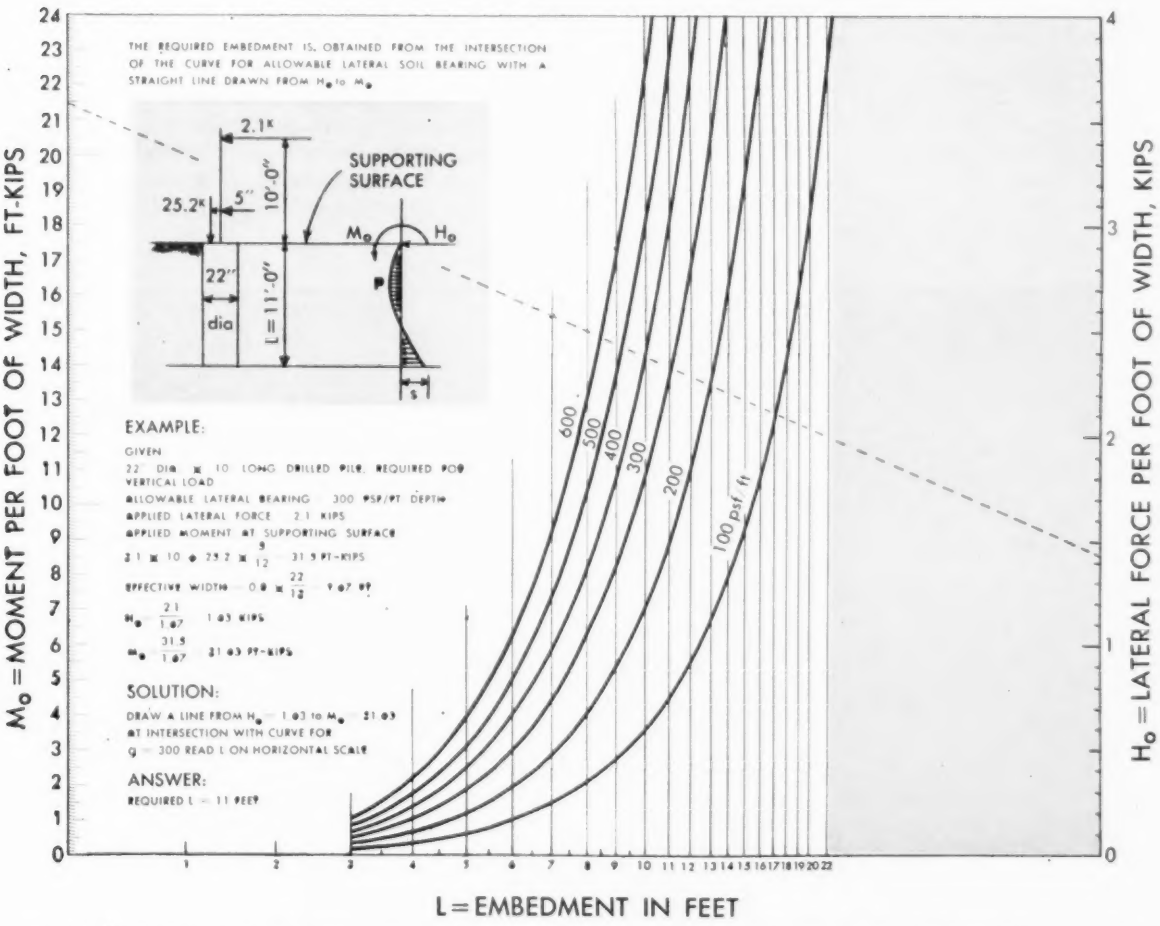


FIG. 6—RELATIONSHIP OF MOMENT, ALLOWABLE LATERAL SOIL BEARING, LATERAL FORCE, AND EMBEDMENT OF PIER

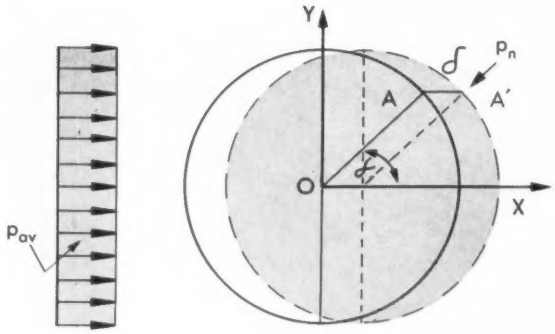


FIG. 7

proportional to the depth of embedment. Fig. 5 shows the pressure that must be developed, against the pile, to maintain equilibrium. The pressure is the product of the unit resistance by the displacement.

Mathematical Formulation

Let the pressure for any point distant x along the pile be p_x. At distance x the unit resistance $= rx/L$, and the deformation $= \delta\ (a - x)/a$. Therefore, the pressure is:

$$p_x = \frac{r\delta x\,(a - x)}{La} \qquad (1)$$

The two independent statical equations are $\Sigma H = 0$ and $\Sigma M = 0$. Let the lateral force and moment per foot width be H_o and M_o respectively. Then, from $\Sigma H = 0$:

$$H_o = \int_0^L p_x dx = \frac{r\delta L\,(3a - 2L)}{6a} \qquad (2)$$

And from $\Sigma M = 0$, taking moments about the ground line:

$$M_o = -\int_0^L p_x x dx = -\frac{r\delta L^2\,(4a - 3L)}{12a} \qquad (3)$$

From (2) $r\delta = 6H_o a/L\,(3a - 2L)$. Then by substituting in (3) and rearranging:

$$a = \frac{L\,(4M_o + 3H_o L)}{2\,(3M_o + 2H_o L)} \qquad (4)$$

Now let $E = M_o/H_o$. Then:

$$\frac{a}{L} = \frac{4\,\frac{E}{L} + 3}{6\,\frac{E}{L} + 4} \qquad (5)$$

Substituting the value of a into (1) we obtain:

$$p_x = \frac{6H_o}{L}\left[\left(4\,\frac{E}{L} + 3\right)\left(\frac{x}{L}\right) - \left(6\,\frac{E}{L} + 4\right)\left(\frac{x}{L}\right)^2\right]$$

To find the location of the maximum pressure in front of the pile set $dp_x/dx = 0$. Then, from differentiating (1):

$$x = \frac{a}{2} \text{ and } p = \frac{3\,(4M_o + 3H_o L)^2}{4L^2\,(3M_o + 2H_o L)} \qquad (6)$$

And at $x = L$:

$$s = -\frac{6\,(2M_o + H_o L)}{L^2} \qquad (7)$$

The solution now can be obtained by comparing the calculated maximum pressures p and s with the allowable earth pressures at distances a/2 and L respectively. It is apparent that the pressure at distance a/2 will govern the design of unrestrained piles. Let g be the allowable lateral soil bearing

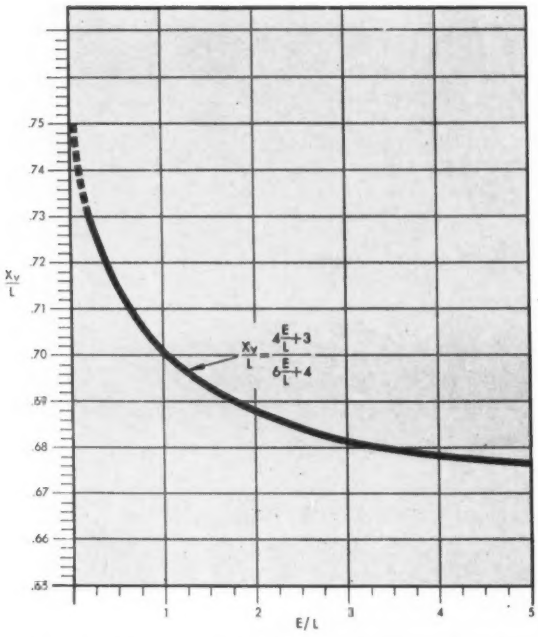


FIG. 8a—LOCATION OF THE MAXIMUM SHEAR FORCE.

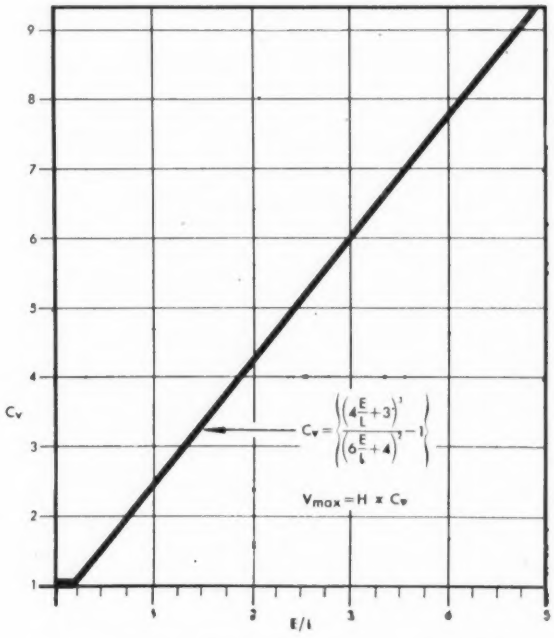


FIG. 8b—COEFFICIENTS OF MAXIMUM SHEAR FORCE.

NOMENCLATURE

- a = Distance from resisting surface to pivot point, ft
- c_m = Bending moment coefficient
- c_p = Average soil pressure coefficient
- c_s = Shear force coefficient
- C_m = Maximum bending moment cofficient
- C_v = Coefficient for maximum shear force
- D = Diameter of pile, ft
- E = Distance from lateral load above the resisting surface, ft (M_o/H_o)
- g = Allowable lateral soil pressure on flat surface, psf/ft depth
- H = Applied lateral force, pounds
- H_o = Lateral force per foot of width, applied at the resisting surface
- L = Depth of pier, measured from the resisting surface, ft
- = Applied moment, ft-pounds
- M_o = Moment per foot of width, applied at the resisting surface
- M_x = Bending moment at distance x from resisting surface
- p = Earth pressure at distance a/2 from resisting surface, psf
- p_x = Earth pressure at distance x from resisting surface, psf
- r = Unit resistance at distance L, pounds per $(ft)^3$
- s = Earth pressure, at distance L, psf
- x = Distance measured from resisting surface, ft
- X_v = Location of maximum shear force, measured from the resisting surface, ft
- X_m = Location of maximum bending moment, measured from the resisting surface, ft
- δ = Deflection at resisting surface, ft

value, in pounds per square foot per foot depth. At a 2, g(a 2) must be equal or less than p.

$$\frac{gL(4M_o + 3H_oL)}{4(3M_o + 2H_oL)} = \frac{3(4M_o + 3H_oL)^2}{4L^2(3M_o + 2H_oL)}$$

From which the expression for the depth of embedment is:

$$L^3 - \frac{9H_oL}{g} - \frac{12M_o}{g} = 0 \qquad (8)$$

The relation between L, M_o, H_o, and g is represented graphically on the alignment chart (Fig. 6). On the chart any four values that lie in a straight line will satisfy equation (8). Hence, when any three of these four values are given, the fourth can be found from the chart.

Allowable Lateral Soil Bearing

When using the expressions and charts for depth of embedment, the magnitude of the maximum pressure against the pile should be sufficiently low so that equilibrium may be maintained without excessive deflection at the ground level. The semi-empirical nature of this subject makes it very desirable that the actual soil resistance and the magnitude of deformation should, wherever possible, be tested by experiment. After the adequacy and class

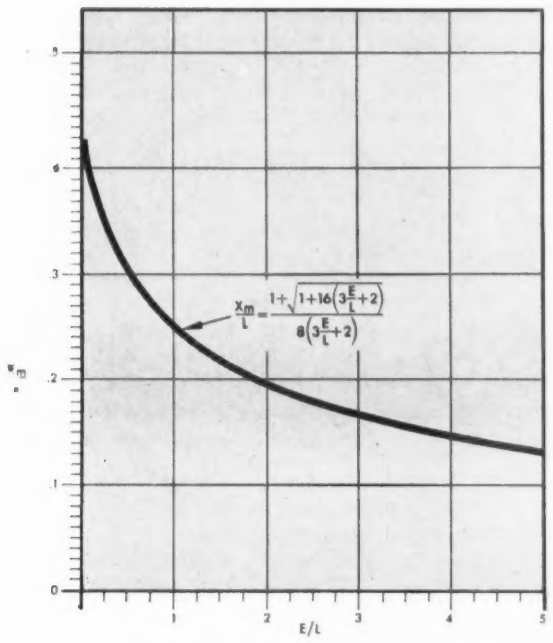


FIG. 8c—LOCATION OF MAXIMUM BENDING MOMENT.

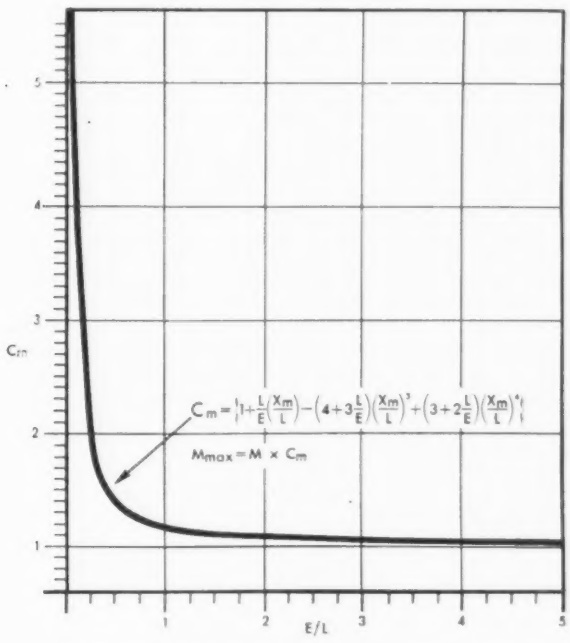


FIG. 8d—MAXIMUM BENDING MOMENT COEFFICIENTS.

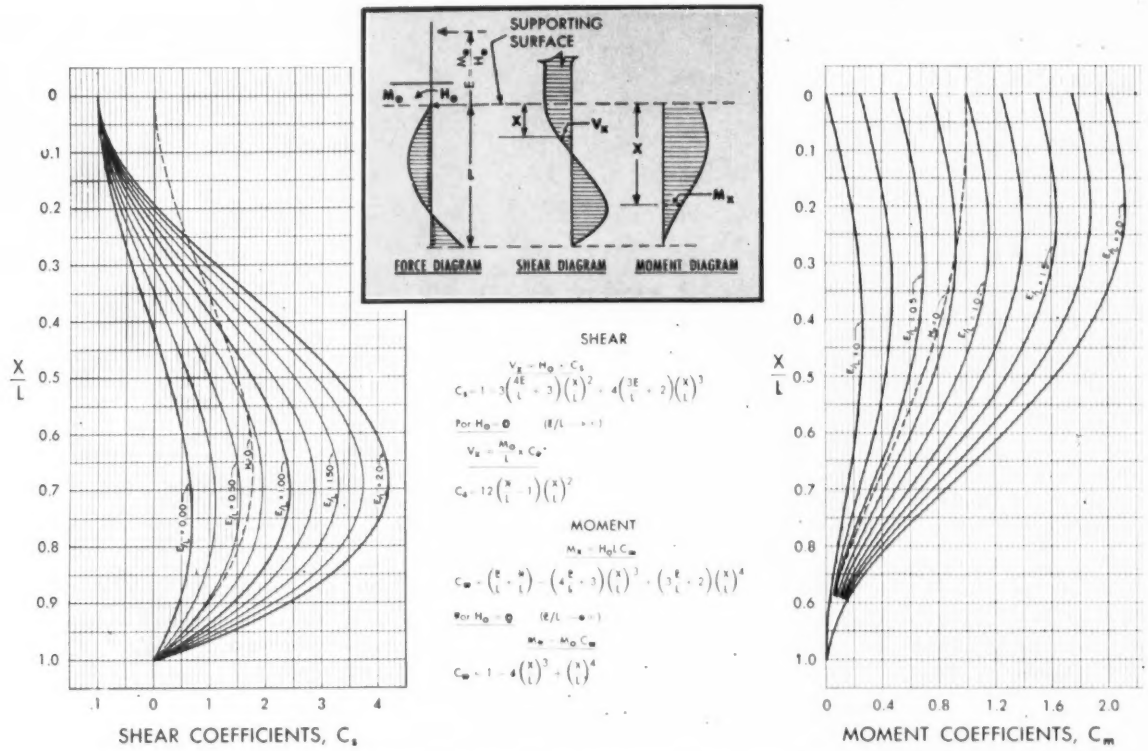


FIG. 9—THIS CHART SHOWS THE VARIATIONS OF SHEAR AND MOMENT ALONG THE LENGTH OF EMBEDDED PIERS

of soil is determined the allowable lateral pressures as recommended in Table 1 may be used. Embedment to resist lateral loading shall be at least four feet into natural soils or properly compacted fill.

Round Sections

The previously developed expressions are applicable to flat surfaces. Since a curved surface can penetrate the earth easier than a flat surface, the effectiveness of the round pile must be decreased. Assume that the resistance developed by the earth is directly proportional to the compression to which the earth is subjected. Thus, as the pile moves a distance δ (Fig. 7) the earth at A is compressed an amount $\delta\cos a$. Then, p_n is equal to $p\cos a$, in which p is the maximum pressure against the middle element (at $a = 0$, $\cos a = 1$).

The components of p_n in the Y direction are equal and opposite on either half of the pile, and act to compress the soil laterally. Thus they aid in the penetration. The component of p_n in the X direction equals $p_n\cos a = p\cos^2 a$, and the element of resistance is $p_n\cos a ds = p\cos^2 a\ (D/2)\,da$

Therefore: $$p_{av}D = p\frac{D}{2}\int_{-\pi/2}^{\pi/2}\cos^2 a\,da = pD\frac{\pi}{4}$$

Hence: $$p_{av} = \frac{\pi}{4}p = 0.785\,p \qquad (9)$$

The effectiveness of the round pile is somewhat higher and a shape factor of 0.8 is recommended. Thus, in considering the resistance of round piles, the effective width may be taken as 0.8 of the pile diameter.

Shear and Bending Moment

Let the shear force and bending moment for any segment distance x be V_x and M_x respectively:

$$V_x = H_o - \int_0^x p_x dx$$

$$= H_o\left[1 - 3\left(4\frac{E}{L} + 3\right)\left(\frac{x}{L}\right)^2 + 4\left(3\frac{E}{L} + 2\right)\left(\frac{x}{L}\right)^3\right]$$

Equation (10)

When $x = a$, $dV_x/dx = p_x = 0$

Hence: $$V_{max} = H_o\left[\frac{\left(4\frac{E}{L} + 3\right)^3}{\left(6\frac{E}{L} + 4\right)^2} - 1\right] \qquad (11)$$

A very close approximation for the maximum shear force may be obtained from a straight line formula:

$$V_{max} = H_o\left(1.76\frac{E}{L} + 0.67\right) \qquad (12)$$

Bending moment along the pile is:

$$M_x = H_oL\left[\frac{E}{L} + \frac{x}{L} - \left(4\frac{E}{L} + 3\right)\left(\frac{x}{L}\right)^3 + \left(3\frac{E}{L} + 2\right)\left(\frac{x}{L}\right)^4\right]$$

Equation (13)

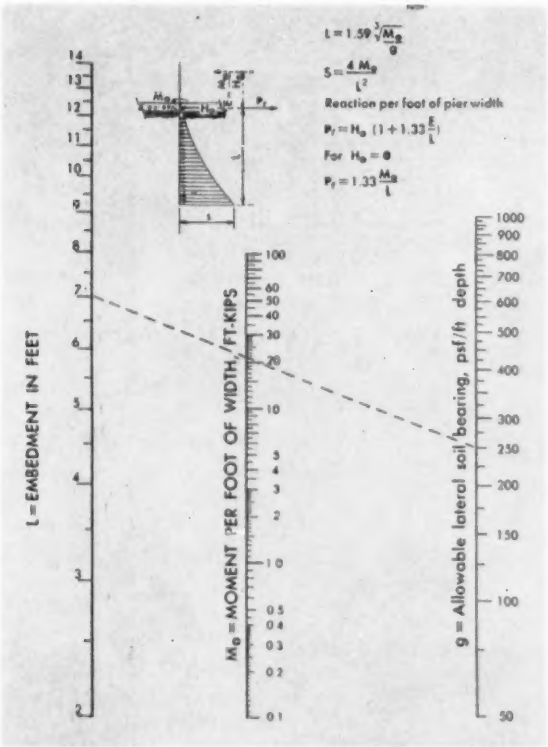


FIG. 10—PIERS RESTRAINED AGAINST TRANSLATION

From $dM_x/dx = V_x = 0$, the location of the maximum bending moment is at:

$$X = L\left[\frac{1 + \sqrt{1 + 16\left(3\frac{E}{L} + 2\right)}}{8\left(3\frac{E}{L} + 2\right)}\right] \qquad (14)$$

And the magnitude of the maximum moment may be approximated by a hyperbola:

$$M_{max} = M_o\left[1 + \frac{1}{5\frac{E}{L}}\right] \qquad (15)$$

Useful Charts

The location of and the coefficients for both maximum shear force and maximum bending moment are plotted in Parts a, b, c, and d of Fig. 8. The variation of shear and moment along the pile is shown in Fig. 9. Finally, Fig. 10 is presented for the case of piers restrained against translation. ▲▲

ACKNOWLEDGMENT

In preparing this paper, the author has drawn freely on material that was published in the Proceedings of the American Society of Civil Engineers: "Resistance to Overturning of Single, Short Piles," by E. Czerniak, Proceedings Paper No. 1188, *Journal of the Structural Division*, Vol. 83, No. ST 2, March 1957.

EXAMPLES

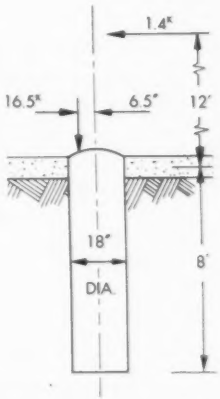
Example 1 — A horizontal load of 300 lbs is applied to a 12″ square pier, which is embedded 6′ into well compacted fill. If g is assumed to be 400 psf/ft depth, what is the maximum height at which the lateral load may be applied?

Solution — On Fig. 6 draw a line from $H_o = .3^K$ to the intersection of $L = 6'$ with $g = 400$. Proceed to Moment scale and read $M_o = 5.85'^K$
Hence: $E = 5.85/0.3 = 19.5'$.

Example 2 — A 12″-dia. pile is used to resist the loading of Example 1. What is the required depth?

Solution — $H_o = 0.3/0.8 = .375^K$;
$M_o = 5.85/0.8 = 7.31'^K$;
From Fig. 6, $L = 6.5'$.

Example 3 — (see sketch). An 18″-dia. × 8′ drilled pile is required for vertical load. A concrete slab restrains the translation. Allowable lateral bearing = 250 psf/ft depth. The applied moment at center line of the concrete slab $= 1.4 \times 12 + 16.5 \times (6.5/12) = 25.73'^K$;
Applied lateral force $= 1.4^K$;
$E = 25.73/1.4 = 18.3'$;
Eff. width $= .8\,(18/12) = 1.2'$;
$M_o = 25.73/1.2 = 21.44'^K$.



Solution — On Fig. 10, draw a line from $g = 250$ to $M_o = 21.44$. Extend line to read $L = 7'$ on left scale. Since the embedment is less than required for vertical loads only, use 8′. Restraining force on pile $= 1.4[1 + 1.33\,(18.3/8)] = 5.67^{KIPS}$

Example 4 — What would be the required embedment if the pile in Example 3 is not restrained?

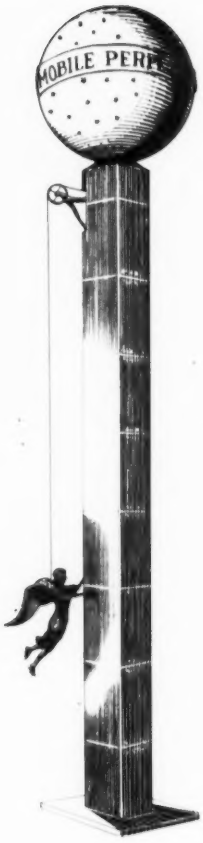
Solution — $H_o = 1.77^K$; $M_o = 21.44'^K$; $g = 250$;
From Fig. 6, $L = 11.5'$.

Example 5 — Determine the maximum shear and bending moment in the pile of Example 4.

Solution — $E/L = 18.3/11.5 = 1.59$
From Fig. 8 (a, b), $X_v/L = 0.69$; $C_v = 3.45$
At $X_v = 7.94'$ below grade,
$V_{max} = 1.4 \times 3.45 = 4.83^{KIPS}$
From Fig. 8 (c, d), $X_m/L = 0.21$; $C_m = 1.08$
At $X_m = 2.42'$ below grade,
$M_{max} = 1.08 \times 25.73 = 27.8^{FT\ KIPS}$
By approximate formulas, $C_v = 3.47$ and $C_m = 1.13$



A FORERUNNER OF THE THERMOMETER, THE THERMOSCOPE, WITH THE INDICATING LIQUID OPEN TO THE ATMOSPHERE, WAS INFLUENCED BY BAROMETRIC CHANGES. VON GUERICKE DESIGNED AN IMPROVED VERSION WHICH IS SHOWN IN THE SKETCH AT RIGHT.



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By D. J. LOVELL

How Fahrenheit Fixed His Scale



D. J. Lovell attended the University of Wisconsin and M.I.T. where he studied physics and mathematics. Later he taught at Wisconsin and at Norwich University. For three years he was with the Naval Research Laboratory, in Washington, following which he became a research physicist. He is at present head of the analytical group within the infrared division of Barnes Engineering Co., Stamford, Conn. Lovell has long been a student of history and the philosophy of science. He says that he considers science the dynamic point of our culture today and that the study of the history and philosophy of science can therefore afford one with a significant insight into life. He is a member of the Optical Society of America, the American Astronomical Society, and the American Association for the Advancement of Science. He also lectures on physics at the Stamford Extension, Univ. of Conn.

DESPITE THE OBVIOUS familiarity we have with the Fahrenheit thermometer scale, the genesis of this scale is obscure. The reasons underlying the selection of such unwieldy numbers as 32 and 212 to signify the freezing and boiling point of water and the significance of zero are subject to a wide variety of interpretations. Zemansky, in a widely used textbook on heat and thermodynamics[1], suggests that the fixed points chosen by Fahrenheit were the temperature of a freezing mixture of salt, ice, and salt solution at atmospheric pressure, and the temperature of the human body; these determining 0° and 96°. Reference to an encyclopedia[2], however, indicates that zero was chosen as the limit of the greatest cold Fahrenheit observed during the winter of 1709, at Danzig. This text noncommittally states that the boiling point was selected as 212°!

Further investigations point to a much wider variety of methods by which Fahrenheit is alleged



to have determined his temperature scale. One of these references[3] states that zero was chosen as the temperature of a mixture of snow and common salt. The interval to the freezing point of water then was divided into 32 parts to determine the degree. There is no inference as to why this number was selected. Another source[4] declares that Fahrenheit selected his zero as the temperature of a mixture of ammonium chloride and ice, with normal blood temperature serving as an upper reference. One also finds[5] that Fahrenheit, an astronomical instrument maker, divided the scale from the freezing point to the boiling point of water into 180 thermal degrees in conformity with the number of angular degrees in half a full circle. This suggests, perhaps, the origin of the word "degree" as applied to thermometric use but fails to clarify the selection of either the numbers 32 or 212. Another reference[6] cites zero as being based as the lowest natural temperature Fahrenheit observed in Iceland.

Uncertain and Divergent Views

One finds yet another reference[7] which quotes Martine, a contemporary of Fahrenheit, as suggesting that although the zero was fixed on Fahrenheit's scale, the rest was determined haphazardly. This resulted, Martine records, merely from the volume of mercury selected for use in the thermometer. The volume used measured 11,124 parts when cooled in ice and sal ammoniac and expanded by 32 parts to 11,156 at the temperature of freezing water. At the temperature of boiling water, it had expanded to 11,336 parts, an additional 180. The differential volume parts were selected as degrees. Commenting upon this scale, Martine is quoted to have said, "I confess there might have been a more convenient one fixed upon at first."

This list, although undoubtedly incomplete, indicates not only the uncertainty associated with the origin of the Fahrenheit scale but also the widely divergent views on the matter. Reference to Fahrenheit's writings[8] does not dispel the confusion. This is so largely because Fahrenheit kept his methods secret for about 18 years. Accordingly, his writings describe his techniques and calibration procedures rather than the motivation that initially guided the selection of reference points.

A Plausible Description

Letters sent by Fahrenheit to Boerhaave during the period 1718-29[7] shed some light but do not settle the question. One letter, for instance, dated April 17, 1729, states that zero was obtained as a mixture of ice and sal ammoniac but does not discuss the point further.

An account of the etiology of this scale seems destined to remain somewhat shrouded in obscurity and uncertainty. Nevertheless, the available historical evidence, viewed against a background of the scientific entelechy of Fahrenheit's time, permits one to reconstruct a plausible description of these events.

Let us begin with a review of the development of the thermometer prior to 1710. From the thermometer's inception as a crude toy to its adoption as a precise instrument took more than a century. Early accounts are unpleasantly pocked with misleading and erroneous statements, many of which have been repeated with such dogmatic assurance that one is led to assign them a false stamp of authority.

Early Temperature Indicators

Galileo generally is regarded as the inventor of the thermometer, or thermoscope, between 1592 and 1597. Valid claims also are cited for Drebbel of Alkmaer, Sanctorio of Padua, and Father Leurechon. These early instruments consisted of a long glass tube connected at one end to a hollow sphere. The other end of the tube was open but immersed in a container of water or wine. The air trapped in the sphere and tube contracted when cooled thereby drawing the liquid up the tube as an indication of the temperature. These instruments were subject to large errors resulting from variations in atmospheric pressure. The method also prohibited rigorous calibration. Hence, the instrument was really a thermoscope, or barothermoscope.

A Closed Instrument

In 1654, Ferdinand II, the Grand Duke of Tuscany, filled a tube with colored alcohol to a certain height, then sealed off the other end. The closed instrument then was graduated. This was the first thermometer unaffected by atmospheric pressure. It is to be noted that Torricelli had invented the barometer in 1643, and a short while later demonstrated the variability of atmospheric pressure.

Boyle's Experiments

Boyle, in England, experimented with thermoscopes about 1665. He believed that the melting point of ice was a function of geographical latitude. Hence, he proposed oil of aniseed as a reference, placing it around the bulb of an alcohol thermometer, allowing the oil to freeze, and marking the height of the alcohol as the oil began to curdle. He maintained that one calibration point was sufficient, the degree being defined in terms of the quantity of fluid used.

Hooke's Thermometer

About that same time, Robert Hooke experimented with an alcohol thermometer having a four-ft long stem. The alcohol nearly reached the top of the tube in the heat of summer and the bottom in the cold of winter. He placed his zero at the



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RENE REAUMUR, WHO ALSO HAS A SCALE NAMED FOR HIM, BUILT THERMOMETERS IN FAHRENHEIT'S TIME.

temperature of freezing distilled water and determined divisions according to the bulk of the fluid.

Suggested Reference Points

Honore Fabri, a French Jesuit, is credited[8] with the first use of two reference points. In 1669, he adopted the temperature of snow in cold weather and the highest summer heat as the lower and upper reference points.

The freezing point of water and the melting point of butter were suggested as references, in 1668, by Dalance of Amsterdam. He divided this region into 10 degrees and established a scale totaling 30 degrees — an additional 10 degrees being added both above and below the initially calibrated scale.

It is interesting to note that Otto de Guericke, in about 1661, installed a thermoscope 20-ft long to indicate the temperature variations during the day.

A large number of early investigators are credited with the invention of the mercury thermometer. This fact is confused by the widespread use of quicksilver as an indicating fluid, but with air or some other fluid as the expanding agent. It seems probable, although it cannot be proved conclusively, that Fahrenheit was the first to use mercury as the expanding fluid.

By the end of the seventeenth century, there were quite a few investigators who favored the use of the freezing and boiling points of water as references for a thermometric scale. However, there were also many who did not believe in the constancy of these temperatures. Sir Isaac Newton preferred linseed oil to the alcohol used as the expanding fluid in instruments by many of his contemporaries. He calibrated his scale with the temperatures of melting snow and of a healthy human body.

Fahrenheit's Background

Daniel Gabriel Fahrenheit was born in Danzig on May 24, 1688. As the son of a well-to-do merchant, he received private instruction at home prior to entering the gymnasium. At the age of 15, misfortune struck young Fahrenheit when he lost both his parents in one day. He was taken from school and sent to serve an apprenticeship of four years in a business house in Amsterdam. Upon completion of this apprenticeship, he left his trade for a study of physical science. He became interested in meteorology. He acquired great skill as an instrument maker, particularly in the making of thermometers, supplying many of the leading scientists of the time.

In 1708, Fahrenheit visited Ole Roemer, in Copenhagen. Roemer, who is best remembered for his determination of the velocity of light by measuring the time of eclipses of the moons of Jupiter, had fixed a thermometer scale in 1702[9]. The calibration procedure Roemer followed involved placing a newly made, uncalibrated instrument in a mixture of snow and crushed ice and marking the stem to indicate this level of the fluid. Next, the instrument was placed in a bath of warm water at a selected temperature determined by a master thermometer, and the stem again was marked to indicate the height of the fluid. The master thermometer had been calibrated originally at the temperature of boiling water. However, since Roemer was preparing instruments intended for meteorological use, it was both unnecessary and cumbersome to extend the scale of these instruments to the boiling temperature. Accordingly, a point was arbitrarily selected which he considered to be the extent of normal usage. To complete the calibration, Roemer measured the interval between the two marks located on the stem, and located a third point half this interval below the lower mark. This point was designated zero. The interval between the two calibration points originally determined was divided into 15 intervals to determine the degree. Thus, on Roemer's scale, the freezing point of water became 7.5°.

Fahrenheit obviously was influenced by this visit. However, he apparently chose to use two natural calibration points in his early endeavors. His upper

calibration point was selected as the temperature obtained "when the thermometer is placed in the mouth or armpit of a healthy man."[9] Fahrenheit, like Roemer, used the freezing point of water for his lower calibration point, and extended the range of the scale below the freezing point temperature to a zero located half the distance of the interval between the two calibrated points. However, Fahrenheit divided the scale into four times the number of degrees used by Roemer. Thus, Fahrenheit originally set the freezing point of water at 30° and blood temperature at 90°.

A few years later, Fahrenheit decided to divide his degree again, this time by a factor of 16/15. This set the temperature of healthy blood at 96° and that of freezing water at 32°. This, in essence, is the scale still in use today. The reasoning that prompted the second change is not entirely clear. It is suggested that this was done to set the upper calibration point at 96°, which has more integer factors, and hence is a more desirable number than 90°. Doing so would eliminate fractions from many of the heat exchange problems Fahrenheit undoubtedly met. However, it is often difficult to appreciate fully the motives for such subtle considerations.

Calibration Techniques

Having thus established a scale in principle, it seems probable that it became desirable to adopt alternative operational techniques to calibrate instruments. Fahrenheit found that zero temperatures could be obtained "by the co-mixture of ice, water, and sal ammoniac, or even sea salt."[7] Curiously enough, Fahrenheit admitted that this experiment worked better in the winter than in the summer! Similarly, it seems probable that the temperature of boiling water was originally measured and found to be 212°, rather than established with 212° as a reference. Subsequently, this was accepted as a calibration point, and blood temperature moved slightly with the new calibration and development of more precise instruments.

One infers that only chance accounts for the coincidence of the number of thermal degrees corresponding to the interval between the boiling and freezing points of water and the number of angular degrees in a half circle. The confusion is compounded somewhat by the earlier use by Sagredo of a thermometer scale divided into 360 degrees[7].

Scholars Agree

This description of the development of the Fahrenheit thermometer scale is in essential agreement with that provided by scholars and philosophers who have considered this particular matter[7, 9, 10]. Other accounts cited earlier presumably are derived from descriptions of the operational technique Fahrenheit used rather than from the true original basis of the scale.

Fahrenheit's contributions were appreciated during his lifetime. In 1724, he was elected to membership in the Royal Society and he contributed his five papers on physics to the Society during that year. He actively associated with many of the leading scientists of the era. He died in Amsterdam, on September 16, 1736, having remained a bachelor during his 50 years of life.

Other Scales

Other thermometer scales currently used were adopted within 30 years of Fahrenheit's work. Reaumur, a Frenchman, worked with an alcohol thermometer. In 1730 he proposed a system which set the freezing temperature of water at 0° and the boiling temperature at 80°. Anders Celsius, an astronomy professor at Upsala, proposed a system, in 1742, in which the boiling point was set at 0° and the freezing point at 100°. This scale was inverted the following year, and with this revision is widely used today in the field of science.

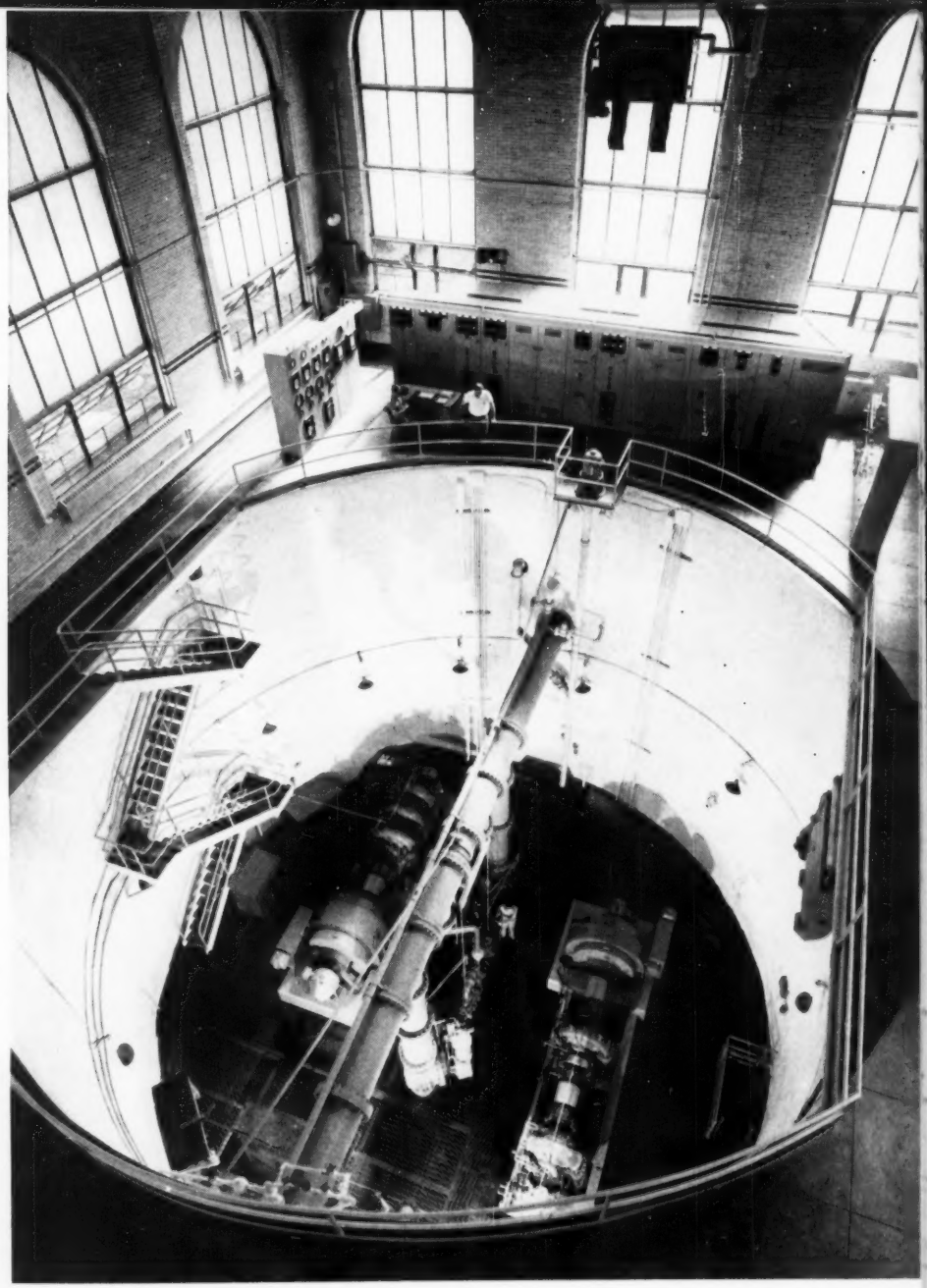
It is interesting that none of the three modern scales is used in the native land of its originator. The Reaumur scale advocated by a Frenchman is used somewhat in Germany. The Fahrenheit scale developed by a German has been adopted in English-speaking countries. The Celsius (centigrade) scale was derived by a Swede and is used in France — and quite universally by scientists.

The genesis of the thermometer scale is typical of many of the developments recorded in the history of science. The harvest of the efforts of many minds contributes to an atmosphere ripe for the final individual accomplishment. Fahrenheit profited from the work of Roemer and his predecessors. It is, however, his contribution that is perpetuated in the scale that bears his name.

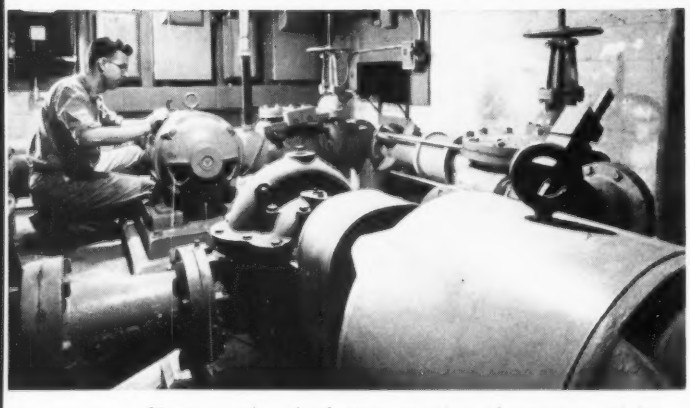
Fahrenheit has been criticized for establishing a scale with such inconvenient numbers as 32 and 212 for reference. It seems probable, however, that few modern scientists working in the scientific climate of Fahrenheit's time would have done significantly better. ▲▲

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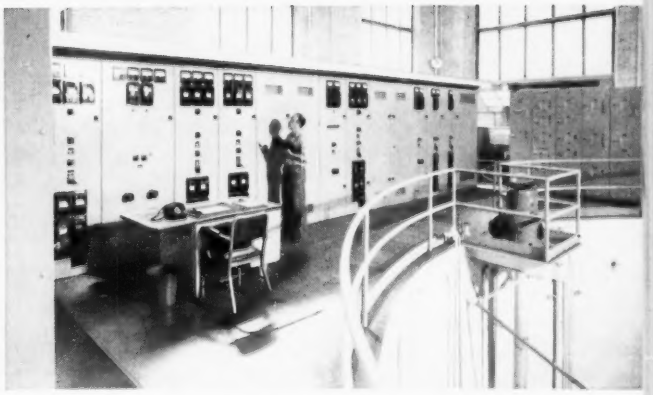
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View at Nadine Pumping Station shows south pump pit containing pumps No. 2 and No. 3 with Westinghouse metal-clad switchgear and control center for all station pump motors in background.



Close-up view in booster station shows two 40-hp Westinghouse motor-driven booster pumps, Westinghouse safety switches, motor starters and power factor correction capacitor.



Metal-clad switchgear includes: incoming line section; starting breakers for 1000- and 1250-hp synchronous motors and their auxiliary field control cubicles; starting and running breakers and reactors for two 2500-hp motors.

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The need for extensive modernization and expansion of water pumping facilities at Nadine Pumping Station of The Wilkinsburg-Penn Joint Water Authority brought about a complete change from steam to electric motor-driven pumps. One new 6.5-mgd pump was added to the three already in use to increase total capacity to 52,000,000 gallons per day.

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The electrical Powering-Up of this pumping station has also made possible a more flexible discharge piping arrangement and the electric operation of valves and other equipment.

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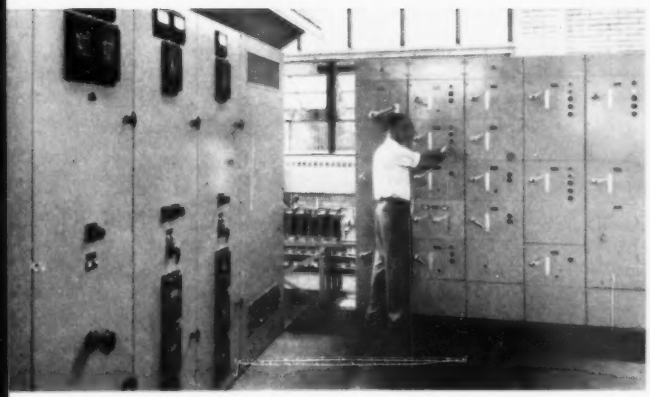
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Shown at left is metal-clad switchgear feeder cubicle and 150-kva dry-type transformer. Motor control center at right contains motor starters and feeder breakers for various station auxiliaries.



Engineering group shown includes: George A. Maibach, Chief Engineer, Nadine Pumping Station; G. V. Gustafson, Morris Knowles, Inc., Consulting Engineers; M. B. Trimble, Westinghouse Construction Sales Engineer.



THE TRADITIONAL, "LET THE CLIENT SEEK US," IS NOBLE BUT IT TENDS TO BE MORE PROUD THAN PRACTICAL.

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VAL LAUGHNER
Val Laughner Associates

SELDOM DO THE MEMBERS of a consulting firm think of themselves as salesmen. Yet no engineering organization ever received a contract without first having sold the client on the firm's ability to perform.

Hide and Seek

Perhaps the engagement comes about because of an excellent reputation or a high-placed recommendation; well-established firms often receive contracts in this way, from clients they have never met. Or perhaps a job results from personal friendship with the client . . . or because of previous work, well done for a particular company. But regardless of how and why contact is established, personal calls upon the client are always necessary before a proposal can be made or accepted — and such calls are sales calls, whether the consultant acknowledges this or not. It is all very well to say, "Let the client seek us; we do not seek the client," and this may be true even today, but after he has sought and found you, he still must be sold on your ability to handle the project.

Such indirect methods of obtaining new business have proved satisfactory in the past and will continue to work well in the future. But many consulting engineers are finding that they must supplement personal contact with more convincing evidence of experience and ability.

There are several reasons for this:

¶ There is insufficient time to meet personally and influence all of the men in all of the organizations —industrial firms, utilities, governmental agencies— that should be in the market for engineering services.

¶ Seldom is a client so completely sold on one consulting firm that he will not consider the use of another firm even in the prenegotiation stage. Ethical engineers do not compete once negotiations are under way between a client and the engineer of his choice, but it would be simply a denial of fact to say that there is no competition prior to negotiation.

Conditions Are Changing

The number of persons to be contacted before a contract for engineering services is negotiated grows

larger every day. Furthermore, it is not always possible to determine the exact man who will influence the awarding of a contract. He may occupy a position of final authority, or one that is only advisory in character . . . he may be with a government bureau or private company . . . he may be located nearby or in another state or another country.

A sound, well-conceived, and professional promotion program can reach far greater numbers of these people than ever can be contacted personally. It can introduce the consultant's name to them at the right time and in the right atmosphere. It can build recognition and prestige throughout the entire field of private practice.

More Than Client Contact

Promotion can do more than introduce a consultant to potential clients. It can, for example, simplify his employee recruitment program. Without worrying about whether there is or is not an engineer shortage, it is a fact that there always has been and always will be a shortage of really good engineers qualified for work in a consulting office. Other things being equal, which firm has the better chance of attracting the best men, the one that is well known or the one that must explain what it does and for whom it does it?

Finally, promotion can be and is a sound method of building staff capabilities and reputation, of helping clients with their communications problems, and of instilling company pride in staff members.

The ordinary type of promotion, the type that connotes unethical practices to many consulting engineers, will not accomplish this. But a program designed specifically for the profession can.

A Sound Approach

A professional promotion program for a consulting firm should start with papers prepared for presentation before engineering societies and manuscripts written for the technical press. These articles or papers can describe specific aspects of a project, or they can deal with basic thinking or techniques that were applied to a design and would be beneficial if understood by others. However, many consultants have the idea that if they developed no new fundamental ideas in completing a project, their experiences would be of little interest to others. This is not so. If a project was unusually large or complicated, required the use of new materials, was done at small cost, or was completed with outstanding results, it may have about it the elements of a good article or paper. On the other hand, if its solution required an investigation of several alternate methods or a survey of current trends, the results could provide the basis for an interesting presentation. These are but a few possibilities.

It is not necessary that these papers be prepared by the principals of the firm. Naturally, such men should do some writing in order to maintain their professional position, but it is also important that staff engineers undertake assignments occasionally. A consulting firm should have men on its staff who have, by their contributions to the literature of the profession, built a sound reputation. Actually, the benefits to the staff are often greater than those that result directly from publication of the material, for no one ever truly knows what he does not know about a subject until he sits down to write about it. If he writes, he not only becomes more proficient at expressing himself, but adds to his knowledge and broadens his perspectives. Staff members, therefore, should not only be permitted to write; they should be encouraged.

Writing For Others to Read

Nor should all of the writing be done for the professional societies or technical magazines. Engineers are a great group for taking in their own wash — for writing to and for people who are their exact counterparts in other organizations. Some writing should be done for those outside the fold. Engineers might prepare stories for management magazines, might write articles that would be of interest to municipal officials, or might prepare material for general magazines going to the lay public. This approach, which is important and has excellent promotional possibilities, is often the most neglected of all. A survey published in this magazine in January showed the great need for educating both the general public and specific client groups concerning the functions of the consulting engineer.

A number of articles and papers of all types, over a period of time, will add substantially to the reputation of an engineering organization. They can, furthermore, be reprinted and mailed to clients who might be interested in the material they contain.

Newspaper Articles

When a consulting firm is involved in a public works project — whether it involves improvement of an airport, relocation of old roads or construction of new, modernization of a water or sewerage system, or design of new schools or public buildings — the public is interested. Often, the public agency is anxious to get material in newspapers. If so, the consultant should offer the cooperation of his organization in developing the material. Much of the writing and picture taking will be done by the newspapers. All the consultant need do is provide the information that is suitable for release. This cooperation with the press is equally as applicable to private client projects where the client desires publicity.

Developing friendly relations with the press in a locality or region has many benefits; the consultant is credited for the work that he does, he is contacted for information before any material is printed, he can better control the accuracy and timing of a release,



THE PRESENTATION OF TECHNICAL PAPERS BEFORE LEARNED GROUPS IS A MEANS FOR FIRM PROMOTION

and he is given a chance to present his side of the story should a controversy arise.

Firm Brochures

A brochure or printed booklet is an invaluable promotional device for an engineering firm. It can be mailed to a client before specific proposals are made to introduce him to the consultant and brief him on his qualifications. It can be left with him at any time as a written reminder.

This brochure should not be promotional in the sense that it makes extensive use of superlatives or takes an outright sales approach, but it should present:

¶ The background of the firm or consultant.

¶ A brief biography of members of the staff along with a resume of their experience and ability.

¶ A description of the types of projects with which the firm has had experience.

¶ Proof of the financial soundness of the firm for the type and size of project handled.

Then a potential client is able to evaluate the ability of the firm to undertake his particular project.

There are many things to keep in mind when preparing promotional literature:

¶ Use a loose-leaf format so that additional pages can be added as new projects are completed and pages can be removed as they become obsolete.

¶ Make the book attractive but not flossy. If it has the appearance of being elaborately expensive, potential clients may wonder who underwrote the cost.

¶ Do not squeeze in every fact about the organization. Leave plenty of white space to improve page appearance and dignity.

¶ Edit the pages carefully, and delete jargon that only other engineers would understand.

¶ Employ a professional to handle layout of the brochure and to select type and paper.

A brochure is of specialized and limited value. Once in a client's hands it has accomplished its purpose. It cannot be distributed again to the same people. So, a consultant needs an additional tool — a quarterly or monthly mailing piece. It should not contain sales promotion material but should be written as a report to prospective clients. A newsletter, for example, is one approach. Several consulting firms have done an excellent job over the years through distribution of a small newsletter that, on a monthly, bimonthly, or quarterly basis, highlights project developments and reports unique solutions to problems.

Company Magazines

Another approach is a company magazine of 8, 12, or 16 pages or more that serves the dual purpose of keeping the staff apprised of the status of various projects and of letting the clients know what is taking place within the consulting organization. Both purposes can be accomplished if care is taken not to build the magazine upon personal items (births, marriages, vacations) but rather on projects and special engineering work.

What the consultant gets out of an approach like this is a reminder to his clients that he is still in business and is undertaking an interesting variety of projects. If this type of mailing is sent out regularly, the client will come to look on it and the firm which supplies it in a friendly manner.

Special Brochures

Occasionally a substantial project is done that is important in some special sense. It might be well to consider a special, limited distribution brochure built around this particular project. The brochure also can be used whenever the consultant is making a proposal on a job of a related nature.

Reports and Proposals

There are other areas of promotion that a consultant can undertake. One obvious approach that should not be neglected is adaption of an impressive format for written reports and proposals.

The matter of writing proposals and of packaging them in an attractive and readable manner is a subject in itself; but once a format is established, the same package can be used over and over again. It often is advisable to obtain professional help in setting up the format and in arranging the best methods for preparing and editing. No consultant would consider going before a potential client in old clothes, battered hat, and worn-out shoes. Yet many present their reports and proposals in packages that, if not downright unattractive, at least are far from appealing. Here is an area in which many firms can improve.

Mailing Lists

In order to make effective use of many of these tools, consultants should maintain a mailing list — and most do. However, most maintain their mailing lists in such a form that they are hard to use —

usually typewritten on individual cards. In every city or town there are office service firms set up to handle this kind of work. They can do a much better job than a consulting engineer's office. In large cities, services can be had that put mailing lists on punched cards, and sort and address those cards whenever the consultant wants to make a mailing. An IBM card can be punched so that not only the client's name and address is contained on it but also any other information desired — whether he represents a military, commercial, or industrial establishment . . . his financial rating, types of work he might want . . .

No matter how the list is handled, someone acquainted with the areas of activity of potential clients must review the list periodically. Doing this will not only keep the list up to date but will act as a reminder of the people and the organizations that should be contacted personally.

What About the Ethics?

There is nothing unethical in any of these practices in the opinion of most engineers. Is it unethical to prepare a report in an attractive, easy-to-read manner so that people who are less expert on engineering matters can understand the proposals and the results of a study?

Is it unethical to develop staff members or to encourage them to become recognized leaders in a particular field of activity? Actually it is an obligation that employers in every field must exercise if this country is to lead in science and engineering.

Is it unethical to supply newspapers with information about public projects — information that the public has a right to know? Who is better acquainted with a solution or a proposal than the consultant who has studied the problem . . . and who can better insure that information on engineering subjects is factually and accurately presented?

If the consulting engineer or firm achieves wider recognition as a result of these promotional methods — as is certain to happen — so much the better. More people learn about the organization and its accomplishments and are thereby in a better position to analyze its capabilities. They also learn more about the whole field of private practice and how it can serve them.

An Ethical Approach

Yes, promotion of this type is well within ethical boundaries. The firms who have not adopted such methods cannot truthfully fall back on ethical objections. They either have failed to see the value of promotion, or they are under the impression that the cost is too high for them. Both objections are false. Smaller concerns, where cost is the deterrent, should re-examine this objection with care. They must start slowly. They cannot undertake a full-scale program overnight. But they can accomplish a great deal at small cost. And as the firm becomes larger, it can consider obtaining the services of an outside consultant or specialist in technical communications. The cost of doing so is nominal — a little more than the salary of one good engineer.

Most consultants make the mistake of hiring a firm with writing and publication ability but no engineering background. It is obvious that, unless the specialist understands what is of interest to engineering readers and unless he recognizes the significance of engineering developments, he cannot perform his function properly.

Finding the right man is not easy, but it can be done through an intelligent approach. ▲▲



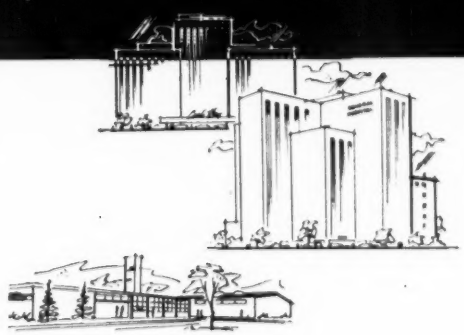
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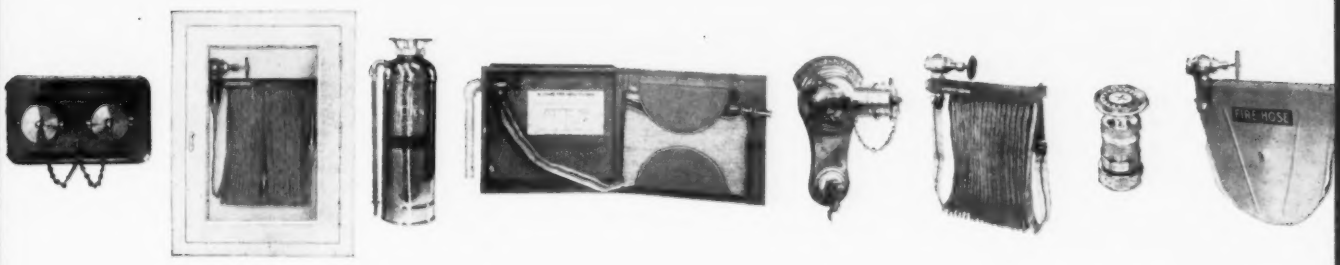
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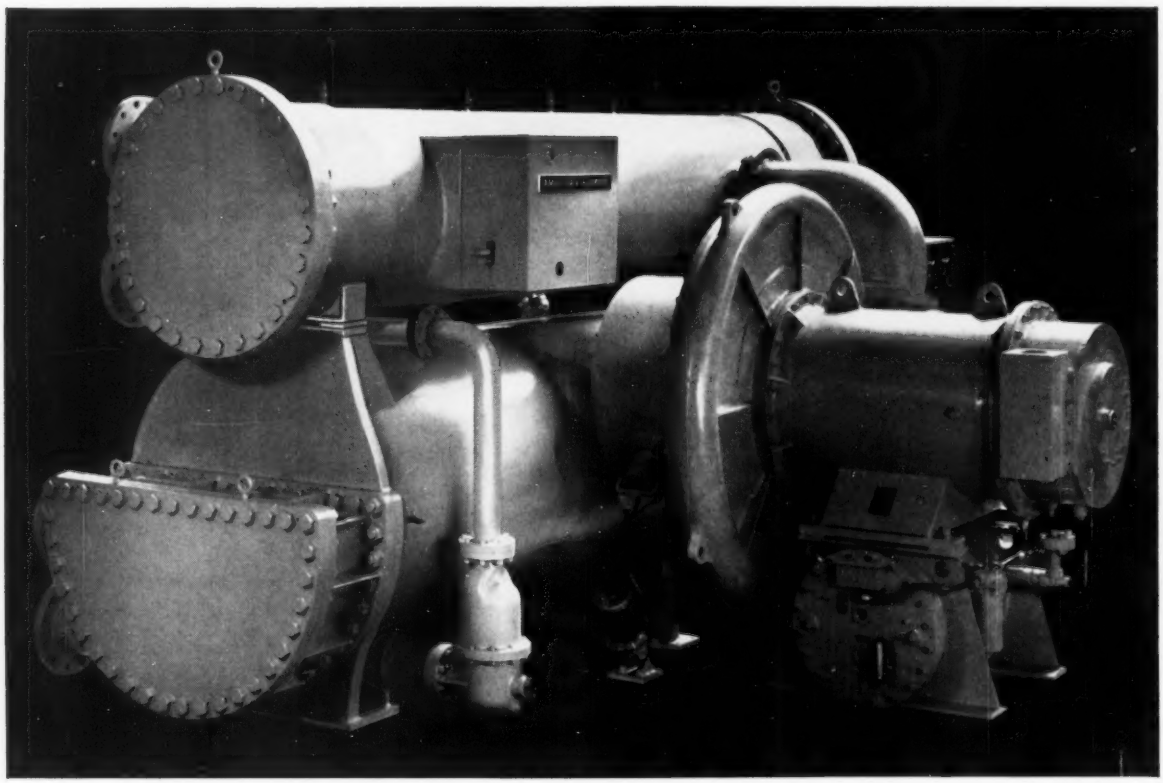
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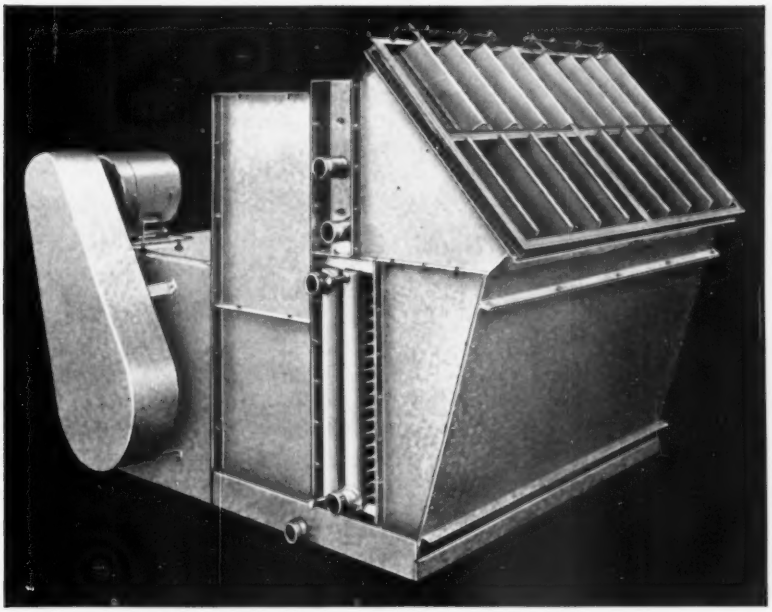
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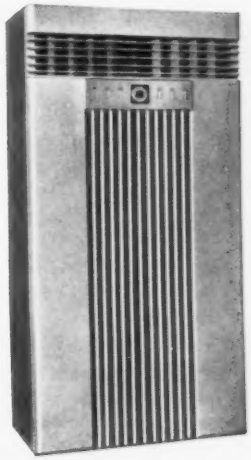
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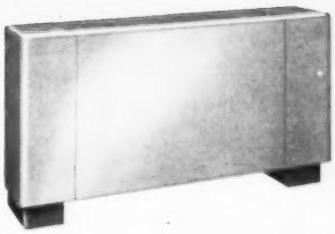
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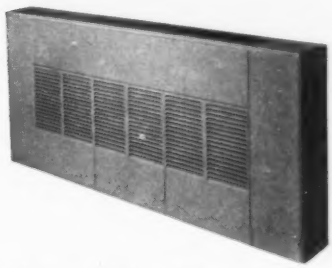
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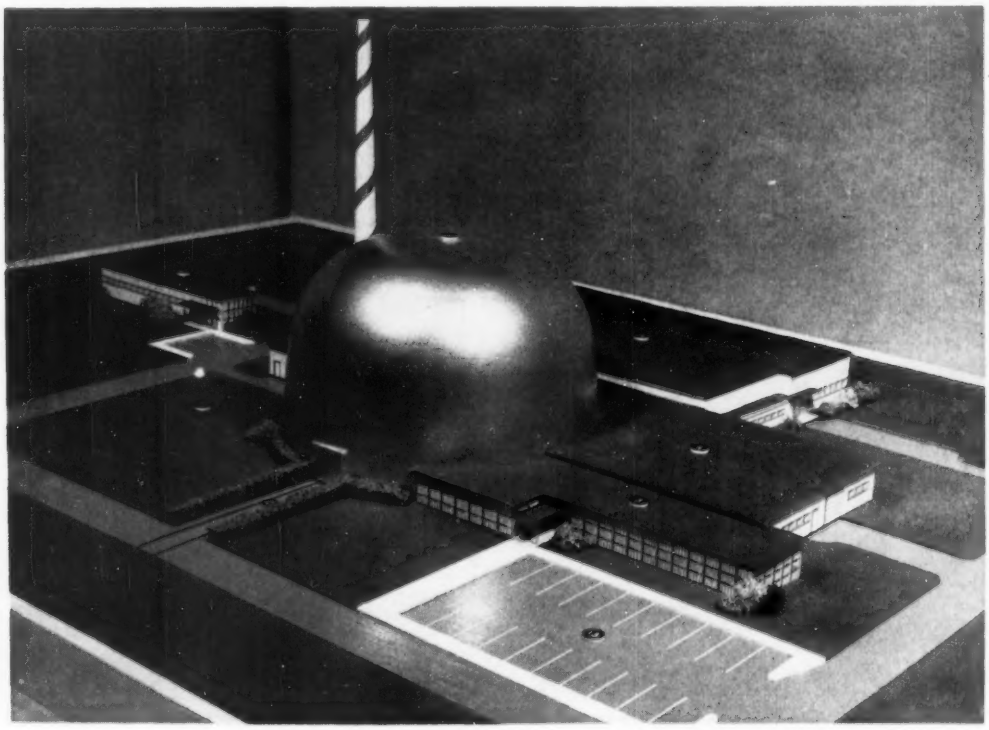
WILBUR E. KELLEY, President
Walter Kidde Nuclear Laboratories, Inc.



FREDERICK A. ZENZ, Department Manager
Walter Kidde Nuclear Laboratories, Inc.

Wilbur E. Kelley, president of Walter Kidde Nuclear Laboratories, was Operations Chief at the U. S. Government Electro-Magnetic U-235 Separations Plant at Oak Ridge, Tenn., from 1942 through 1944. He then became area manager of the Madison Square Area of the Manhattan Project, and in 1947 was appointed manager of the Atomic Energy Commission's New York Operations office. Later he became vice president for engineering at the Catalytic Construction Co. before being made head of Walter Kidde Nuclear Laboratories. He has graduate degrees in civil engineering and an honorary doctorate from the University of Louisville. He is registered in New York and Kentucky and is a member of ASCE, AIChE, and the American Nuclear Society.

Frederick A. Zenz worked as an engineer at the Kellogg Corp., Carbide & Carbon Chemical Corp., and Hydrocarbon Research, Inc., before becoming development engineer for the M. W. Kellogg Co., where he supervised experiments on and the design and analysis of fluid bed reactors. In 1956 he joined the Walter Kidde Nuclear Laboratories as department manager. He has published over 30 papers on distillation and multiphase flow, and lectured on fluid flow at the graduate division of New York University. He has a B.S. from Queens College and a Masters in chemical engineering from N.Y.U. He is a member of the American Institute of Chemical Engineers, the Scientific Research Society of America, and the American Chemical Society.



TYPICAL PLANT ARRANGEMENT OF RESEARCH REACTOR FACILITY IN A SUBURBAN LOCATION.

Nuclear Engineering for Consultants

CE exclusive

THE CONSULTING ENGINEER'S role in the field of nuclear technology is as yet not well defined. While this might be said to be due to the infancy of the nuclear industry, it is doubtful if a strict definition can be evolved in the near future. Numerous noneconomic forces instigated the birth of the industry, and since these forces still are acting today, it is to be expected that future development will continue in an unnatural fashion. For example, in the power field nuclear reactors are being built and will continue to be built even though they produce power at a cost much higher than coal-fired plants. The usual economic and competitive forces in a free society are lacking. Without a sound economic basis, equipment or services need not be purchased from the groups most qualified to supply the product at the best price.

The consulting engineer, therefore, is not able to offer his services on the basis of competence. At present, his particular role is assigned by his customer to an extraordinary extent, and it is different for each customer. He survives in this field only because his broad experience allows him to investigate an entire range of seemingly unrelated problems, and hence he can satisfy the particular needs of numerous clients. The full breadth of his activities in the commercial nuclear consulting field varies from simple site monitoring surveys and recommendations on the safe handling of radioactive materials to the detailed design of reactors and complete power plant installations.

The Market Potentials

Until recently, about the only nuclear facilities other than those directly related to the weapons program have been research reactor installations. The necessity for in-pile experimentation for the development of power reactors assures a continuing need for these research reactor facilities. In fact, future demands for research reactors can best be appreciated by noting their rate of growth over the past decade and the projects planned abroad. As shown in Fig. 1, the current total power of all research reactors built in the U. S. is at a level that Japan plans to attain only six years from now.

Construction in the U. S. now has reached a point where private organizations are becoming the major interests investigating the potentials in radiation research. The projected plans shown in Fig. 1 for Japan are typical of current government-sponsored programs abroad and represent a significant major market potential.

The emphasis in reactor construction in the U. S. now is shifted to power generation. Though only two government-sponsored reactors are in operation at the present time (the Army Package Power Reactor, APPR; and the Experimental Boiling Water Reactor, EBWR) there are 14 power projects currently planned or under construction. These will bring our electrical power production from nuclear sources to a total of 1.5-million kw by 1961. Plant costs to the utilities engaged in these ventures, totaling nearly $400 million by 1960, gives a monetary indication of the market potential of the power reactor field.

Again, with a five- to six-year lag, the Euratom nations, India, and Japan have plans to equal, if not exceed, our projections. Fig. 2 shows a comparison of planned electrical power generating capacity for some of the major countries over the next 40 years. Projections of future power needs are strongly dependent on costs, reserves, and availability of coal and oil, so figures beyond 1970 might well be revised upwards.

A vast field of atomic applications has as yet only been touched. Its development will depend on the results of numerous research programs looking into the effects of irradiation. Cobalt 60 and spent-

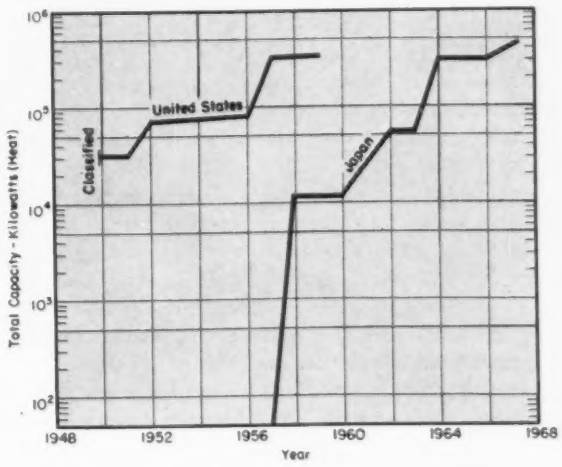


FIG. 1—JAPAN'S DEVELOPMENT PLANS COMPARED TO U.S. FACILITIES IN THE RESEARCH REACTOR FIELD.

fuel-element gamma irradiation facilities, Van de Graaff generators, linear accelerators, and resonant transformers are now in existence. Radiation effects studies are being carried out to determine possible utility in food and drug sterilization and processing, and in chemical catalysis and production. The study of reaction kinetics in a radiation field and the activity of irradiated catalysts is being widely explored. The use of nuclear reactors in industrial chemical plants as a combined source of process heat and of radiation catalysis may well open up a wide and varied market.

Twelve of the major oil companies representing the leading industrial interests in this field now possess either gamma sources, electron machines, or both. Socony is participating in a nuclear reactor project. Gulf has reported production, by irradiation, of hexamethylethane, a high quality 130 octane gasoline component, from refinery gases. Esso has reported enhanced catalytic cracking through the use of irradiated catalysts. It also has been shown that the yield of hydrocarbons from Fischer-Tropsch synthesis can be increased 10 to 40 percent with irradiated catalysts and that certain organic chlorination, polymerization, and oxidation reactions, some of which have never before been observed, exhibit high radiation efficiency. The effects of radiation on chemical reactions have only begun to be explored, but it seems certain that such a unique and powerful tool eventually will find widespread use in the process industries.

The Role of the Consulting Engineer

The architectural and structural features of plants employing nuclear power present a new characteristic appearance on the horizon. The stringent requirements of radiation shielding, minimum exposure of personnel, and protection of the public at large from atmospheric pollution with radioactive waste gases, gave rise to the typical large dome-shaped container surrounding the active portion of the plant, the 200- to 350-ft stack, and the preferred remote suburban location. A typical plant layout for a suburban research reactor facility is illustrated.

Shielding of radioactive areas within the plant usually requires reinforced concrete walls ranging from 2 to 5 feet in thickness. The steel reinforcement, in addition to the spherical or cylindrical container vessel, greatly increases the quantity of steel required in a nuclear power plant as opposed to a conventional oil and coal fired design. Similarly, the volume of shielding concrete alone exceeds that normally required for conventional buildings and turbine floor foundations.

For example, a 60-MW nuclear power plant may require approximately 50,000 yards of poured concrete and nearly 8000 tons of steel; a conventional plant of this electrical capacity takes about 23,000 yards of concrete and 3500 tons of steel. Except for

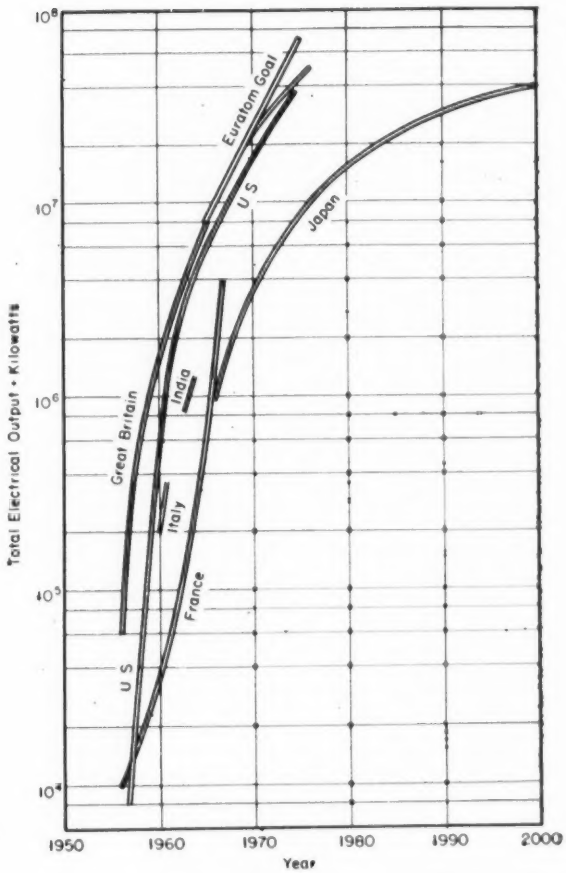


FIG. 2—PLANNED ATOMIC POWER REACTOR CAPACITIES IN UNITED STATES AND SELECTED COUNTRIES ABROAD

the containment shell, none of this added mass is evident in the outward appearance of the plant, which has done away with the coal yard, the conveyors, the soot, the smog, and the odors.

Unique Features

Within a nuclear power plant or research reactor facility there are a number of features unique to this industry. These require special consideration.

¶ Hot laboratories or other remote handling facilities for examination and maintenance of radioactive components.

¶ A "health physics" office and check-out area where instruments and records can be kept for checking radiation levels and exposure of personnel.

¶ A waste disposal plant for concentrating and packaging radioactive wastes, which must be removed from the plant and disposed of elsewhere.

¶ A monitoring station where continuous watch is kept on the amount and activity level of various isotopes discharged from the plant stack and from sewage streams.

¶ A fuel handling and storage area consisting usually of a pool of continually cleaned water. The removal

and replacement of a core or core parts requires a complex arrangement of canals, locks, gates, and submerged storage pits, together with special precision cranes for remote handling of materials entirely under a shield of water, which usually is approximately 20-ft deep.

¶ In some instances it is advisable to set up a meteorological station to guard against stack discharge of gaseous activity during weather conditions unfavorable to dispersal.

¶ A radiochemistry laboratory for continuous checking of contamination and corrosion that may occur throughout the entire plant.

These are but a few of the novel features incorporated in nuclear facilities and indicate the broad field of talents required in the original design work as well as the final construction.

Facilities Planning

The need for planning of the over-all facility rather than consideration of the reactor as a separate piece of equipment is demonstrated excellently by current research installations. The design of a test reactor facility influences the nature and extent of experiments that can be performed in and around the reactor proper. The optimum design results from an analysis of the desired experiments and the selection or custom design of a reactor to fit the program. The importance of the facility design in relation to the reactor itself is illustrated by the fact that in a research facility costing $2 million, the reactor proper may cost only $150,000 — about 7.5 percent of the total cost. Obviously, prior analysis of the full scope of a projected facility is a proper course of action before a specific reactor design is permitted to determine the capabilities and arrangement of an entire plant.

The economics of a specific design are more nearly determined by consideration of such items as siting, layout, shielding, containment, maintenance, and accessibility.

Licensing Procedures

With the variety and number of facilities rising rapidly both in this country and abroad, the regulations governing the licensing of facilities by governmental agencies are getting progressively more strict. Offsetting this trend is the gradual accumulation of evidence that past precautionary measures have been quite adequate. Judicious projection in the early stages of design of probable future restrictions requires a constant appraisal and coordination of developments in radiation control, decontamination processing, public health surveys, and AEC policy changes in conjunction with the projections on operating and planned installations.

In order to protect innocent third parties in addition to those directly connected with the plant, AEC requires that before a plant goes into operation, it will have gone through the following stages:

¶ Preliminary hearings with the reactor hazards evaluation staff of the AEC Advisory Committee on Reactor Safeguards.

¶ Application for a construction permit.

¶ A Class 103 license permitting operation—granted upon completion of the facility and after review of the application assures the AEC of plant safety.

The license application requires a complete description of the proposed facility, the site, and the operations to be performed. It requires an evaluation of measures and devices to prevent accidents that would create radioactive hazards and an evaluation of measures and devices to protect against the consequences of accidents should they occur.

Site Selection

The selection of a site and the preparation of an acceptable hazards analysis report for a nuclear plant is considerably more complex than the selection of a site for a conventional plant. The hazards analysis requires not only the conventional surveys of population density, available natural resources, land area . . . but also analysis of the local meteorology, hydrology, and geology on a competent technical level. Wind directions and currents leading to dispersal of gaseous wastes away from human and animal populations (as well as away from agricultural crops) must be appraised for long periods of time during all seasons. Similarly, in the event of radioactive spills, the soil conditions and substrata should be studied to evaluate permeability and leaching action as related to ground water flows and contamination of water supplies of distant communities.

The criteria by which such an evaluation is judged by the AEC has been appropriately summarized by K. E. Fields, AEC General Manager:

> "The safety of a reactor is dependent upon the interrelated effects of design, operating procedure, supervision, contamination, and location. No one of these factors is of overriding importance and no one can be considered alone. We apply the general criterion that a given site is considered acceptable only if, after analysis of the reactor design and operating procedure to determine the nature and magnitude of the maximum credible accident, it is concluded that the proposed reactor housing can be reasonably expected to contain the fission products released by such accident to a degree that would prevent overexposure to the public at the nearest site boundary."

Site Monitoring

Once a site has been selected and a construction permit issued, it is advisable to initiate a site monitoring program. Nuclear plants are still sufficiently novel and the long-term effects of radiation on the human body still so mysterious that unless quantitative evidence of the radioactive background of the surrounding areas is verifiably recorded, the

TABLE 1—DEGREE OF ISOLATION OF EXISTING AND PROPOSED NUCLEAR POWER PLANTS

Reactor and Location	*Reactor Power and Type**	*Distance to Nearest Major Population Center, Miles*	*Population Density** (Persons per sq. mi.) Within 30 Mile Radius*
Shippingport Beaver County, Pa.	260 MW — PWR	Approx. 26 miles to Pittsburgh	About 400 (excluding Pittsburgh)
STR Mark I Arco, Idaho	About 60 MW — PWR	Approx. 40 miles to Idaho Falls	Less than 25
Yankee Electric Rowe, Mass.	480 MW — PWR	18 miles to Greenfield 16 miles to Williamstown 25 miles to Pittsfield	Less than 200
Consolidated Edison Indian Point, N. Y.	500 MW — PWR (177 MW — Oil-fired Superheater)	24 miles to New York City line	Approx. 1500 to east Approx. 500 to west (excluding New York City)
Argonne Labs Lemont, Ill.	20 MW — BWR	Approx. 29 miles to Chicago	Approx. 400 (excluding Chicago)
Commonwealth Edison Dresden, Ill.	630 MW — BWR	Approx. 20 miles to Joliet Approx. 30 miles to Ottawa 50 miles from Chicago	Less than 200
Enrico Fermi Monroe, Mich.	300 MW — Na Fast	30 miles to Detroit	Less than 200 (excluding Detroit)
General Electric Co. Vallecitos, Calif.	12 MW — BWR	40 miles to San Francisco	Approx. 1010

*Power given is heat generation rate; PWR: pressurized water reactor; BWR: boiling water reactor; Na Fast: Sodium-cooled, fast breeder.

**Excludes major population centers within 30 mile radius.

operating company could well become the innocent target of a variety of irrefutable claims. Minor changes in the background activity occur periodically in nearly every locale as a result of bomb tests. Monitoring programs can incorporate provision for storage of labelled, witnessed, signed, and sealed representative samples. Detailed procedures for collecting and establishing legal authenticity of samples have been developed by organizations specializing in those services.

Accident Analysis and Hazards

Since a reactor is a highly concentrated source of heat, failure can occur as a result of extreme temperatures and pressures. It should be pointed out that the ultimate reactor accident, although frequently spoken of as a reactor "blowing up," has no relation to an A-bomb explosion or, for that matter, any high order explosion. Any explosion that could occur is one due to high pressure build-up similar to a steam boiler rupture. The principal hazards involved in nuclear plant accidents involve the dispersal of lethal radioactive by-products, always present in the reactor core. An analysis of the hazards involves evaluation of a facility under several situations:

¶ It should be clearly demonstrated that any normal fluctuations in power demand, pressure, and temperature will not result in instabilities.

¶ While some minor failures are certainly to be expected, it should be shown that plant shutdown can be achieved before these failures result in major damage to the plant or hazard to personnel.

¶ The worst conceivable accident should be analyzed no matter how small the probability for occurrence. The cause of the accident should be clearly outlined, the magnitude of damage assessed, and it should be shown that there is only minor hazard to off-site population.

¶ Even though the anticipated probability for occurrence is zero, the maximum catastrophe should be described. The resultant hazard to surrounding areas will demonstrate the necessity for a strong safety philosophy with strict administrative control.

The maximum credible accident is most likely to determine the location of the site, since a minor increase in investment usually can make normal operation completely safe. However, the potential threat of the ultimate catastrophe endangers off-site areas to a degree far greater than does any potential threat imposed by the operation of conventional nonnuclear industrial facilities.

Containment

The concept of the wholly contained power plant designed to hold all fission products from the maximum credible accident has revived the promise of abundant nuclear power adjacent to population centers and has stimulated intensive study of the applications of this idea. Table 1 gives a comparison

of the power levels, degree of isolation from major cities, and approximate rural population densities near a number of proposed power plants.

An alternate approach to containment is the provision of an exclusion area. In order to be acceptable to the AEC Reactor Safeguards Committee, this would call for so large and so remote a plant site that land costs and power transmission charges would far exceed the cost of construction for complete containment.

Vessel Design

Containment vessels are generally cylindrical or spherical, the choice of shape depending on the layout of the plant components and the reactor system employed. The optimum shape depends on the particular plant and site under consideration. This requires a complex cost balance involving excavation, steel plate thickness, equipment layout, design pressure, and erection costs.

To minimize the size of the container, a design for the highest practical pressure is desirable. High pressure, however, makes it difficult to seal the multitude of necessary penetrations. These penetrations include airlock personnel entrances, equipment hatchways, electrical connections, and piping. Some compromise must be reached. Container design pressures have ranged from 15 to 50 psig. The design pressure is the value that would be attained inside the container in the event of a maximum credible accident and the release of all process streams. This includes results of all possible chemical reactions that might occur during or after an accident.

Table 2 summarizes the available information on some typical containment vessels. Note that the permissible 24-hour leak rate specifications range

TABLE 2—AVAILABLE INFORMATION ON CONTAINMENT VESSELS

Reactor, Type, Heat Output, and Location	*Container Size, Shape, and Volume*	*Container Shell Thickness and Design Pressure*	*Permissible Leak Rate*
Pressurized Water Reactor (PWR) Pressurized Water Type 232 MW Shippingport, Pennsylvania	Container is divided into four sections: 1. Reactor vessel — Spherical shell 38-ft diameter with an 18-ft cylindrical dome 2. Primary coolant loops and associated equipment—Two, 50-ft diameter cylinders, 97-ft long 3. Pressurizing tank and other auxiliaries—cylinder 50-ft diameter and 147-ft long 4. Interconnections—8-ft and 12-ft diameter ducts Free Volume—473,000 cu ft	Reactor vessel is constructed of carbon steel plates and forgings with 1/4-in. stainless steel cladding. Nominal vessel wall thickness is 8 1/2 inches. Auxiliary containers are designed in accordance with ASME Boiler and Pressure Vessel Code for Unfired Pressure Vessels. Design pressure, 53 psig	Leakage specification—Maximum leak rate 0.1% of container volume at 52.8 psig in 24 hours. Vessels will be leak tested at 1.25 times max. allowable pressure as required by ASME Code
Cons. Edison Indian Point Reactor Pressurized Water Converter Type 585 MW Indian Point, New York	Steel Sphere 190-ft diameter, located partly below grade	Sphere is constructed of SA-201 steel plates 7/8-in. thick. Design conforms essentially to ASME Boiler Code, Section VIII. Design pressure, 23 psig	Specifications allow leakage from container at rate of 1% of container volume in 48 hours. Vessel will be pressure tested at 28 psig
Experimental Boiling Water Reactor (EBWR) Boiling Water Type 20 MW ANL	Steel cylinder 80-ft diameter, with a hemispherical top head and a hemi-ellipsoidal bottom head and having a total height of 119 feet. Free Volume—400,000 cu ft	Cylindrical portion and bottom head are of 5/8-in. steel plate, top head is 3/8-in. steel plate. Design conforms to Section VIII. ASME Pressure Vessel Code. Design pressure, 15 psig	Leakage specification — Maximum Leak rate 500 cu ft in 24 hours, equivalent to 0.13% of container volume in 24 hours
Homogeneous Reactor Test (HRT) Homogeneous Type 5-10 MW ORNL	Rectangular containment vessel 54-ft long, 30 1/2-ft wide and 25-ft deep. Free volume 25,000 cu ft	Containment tank is constructed of reinforced 3/4-in. welded steel plate. Design pressure, 30 psig	Leakage specification — Maximum leak rate limited to 100 cc/min at design pressure, equivalent to about 0.2% of container volume in 24 hours. (Vessel was hydrostatically tested at 32 psig)
Enrico Fermi Reactor Fast Breeder Type 300 MW Lagoona Beach, Michigan	Container is a cylindrical pressure vessel 72-ft diameter and 120-ft high over-all with a hemispherical top and an ellipsoidal bottom. The containment building is surrounded by a biological shield of concrete 7-ft thick	Vessel will be constructed according to Section VIII, ASME Pressure Vessel Code. A-201 steel plates approximately 1-1/16-in. thick will be used throughout. Design pressures, 32 psig (pos) & 5 psig (neg)	Leakage specification — Maximum leak rate 1% of container volume in 24 hours at design pressure

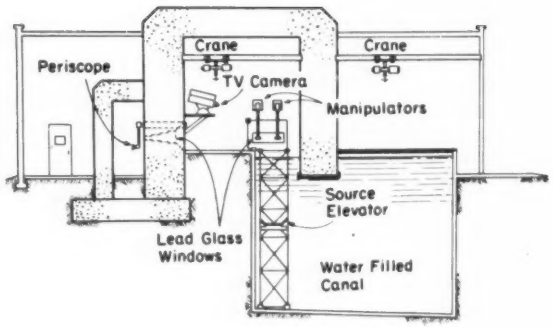


FIG. 3—VERTICAL SECTION OF CONOCO ATOMIC RADIATION LABORATORY LOCATED AT PONCA CITY, OKLA.

from 0.1 to 1 percent of the container volume. Special techniques have had to be developed for leak testing these enormous vessels after construction. Simple recording of pressure loss with time is inadequate, since the contained volume is so large that normal fluctuations in ambient conditions during the course of a day create internal pressure changes far exceeding those corresponding to the minute permissible leak rates.

Differential measurements against a smaller pressure-tested drum inside the container, subjected to the same ambient temperature drifts, has been used successfully.

Shielding

Thermal and biological shield thicknesses have an important bearing on building costs in nuclear power plants and research facilities. The problems of biological shield design have to do with protection of personnel from the gamma and neutron radiations, which are the most penetrating types of radiation produced in an operating nuclear reactor. An inner thermal shield prevents excessive heat generation in the biological shield so that no auxiliary shield cooling is necessary.

TABLE 3— RELATIVE COST AND EFFECTIVENESS OF VARIOUS GAMMA-RADIATION SHIELDING MATERIALS

Material	*Thickness For a 10^6 Attenuation Factor, feet*	*Weight Per Sq Ft of Shielded Surface, lbs*	*Installed Cost Per Sq Ft of Shielded Surface, **$*
Lead	1.162	827	620.00
Iron	1.962	961	770.00
Barytes Concrete	4.82	1052	43.80
Aluminum	5.80	976	585.00
Ordinary Concrete	6.43	924	28.60
Carbon	9.25	964	578.00
Water	13.69	854	variable*
Polyethylene	15.27	875	1090.00

* Requires concentric pressure vessel as container (usually applied only in swimming pool type installations, and fuel handling and storage canals, etc.)

** Note that prices of materials other than concrete or water are so large that their use becomes generally prohibitive even if combined with other materials as a composite shield.

Selecting Materials

The choice of shielding materials for nuclear facilities is governed by a variety of factors. If the gamma energies are predominantly in the region of 1- to 3-million electron volts, the attenuation of the shield is fixed primarily by the mass per unit area. A secondary effect, more marked at higher and lower gamma energies, is the increased effectiveness, even on a mass basis, of materials of high atomic number. Thus, a lead shield can be thinner than a concrete shield by a factor somewhat greater than the ratio of their densities. Similarly, high density concrete aggregates are more expensive than the normally used concrete, but sometimes have overwhelming advantages. Fig. 3, which shows approximately to scale a cross section of a gamma radiation laboratory, illustrates the relative mass of concrete shielding required for even simple facilities.

Through Thick and Thin

When a source of small dimensions has to be shielded by a thick shield on all sides, the approximate shield thickness will be inversely proportional to the density, while the mass will be nearly proportional to the cube of the thickness. A thin, dense shield clearly will be very much lighter than a thicker one of lower density, and lead or even steel is therefore commonly used in transport containers or as shielding around small process vessels.

Another prime example is a shield through which a number of manipulators will have to pass. The cost of lead for these shields is high, but the manipulators can be fairly simple. A thicker, low density shield would require very much more complicated and expensive devices for remote handling of radioactive materials.

Material Comparisons

Table 3 gives a comparison of the thicknesses of various materials required to give an attenuation factor of 10^6. The densities and approximate costs per square foot of installed shielding surfaces also are shown.

For biological shielding, experience has shown that water, iron, and concrete are the most practical materials of construction. In practice, water is conventionally used in fuel handling and storage pools where heat generation in the fuel element forms must be dissipated and where direct visibility during the fuel transferring and storage operation is

possible. Though iron has relatively good attenuation characteristics, its installed cost limits its application primarily to thermal shielding.

Polyethylene is another material worth mentioning for direct reactor shielding, particularly where weight is a prime consideration. This material is relatively simple to apply as precast interlocking slabs or even by means of a flame spraying technique. It is limited to outer surface shielding where temperatures are relatively low. Special polyethylene materials impregnated with lead dispersions also are available.

Pourable Shielding

Use also has been made of simple lead shot or lead powder rather than sheets or plates. The lead-burning art is not practiced as widely as conventional steel welding, therefore, lead-lined shielding sometimes can be replaced by the metal in powder form — simply pouring it into an annular retaining vessel. This is particularly desirable in instances where it may be necessary to move the shielding at a future date or where space or hoist limitations make it difficult to move in a heavy piece of equipment. The advantages of being able to pour and drain the shield may outweigh the necessity of making the shield somewhat thicker to offset absence of metal in the interstices between the particles. In certain instances it is possible to fill these voids with water and regain some interstitial losses.

Shippingport Shielding

The concrete and steel reinforcement used in just the biological shielding for the Shippingport plant equalled the total steel and concrete normally required for an entire conventional power plant of equal generating capacity. This shielding, in the form of concrete walls ranging from 2 to 5 feet in thickness, may either externally surround the containment vessels, as at the Shippingport plant, or may consist of equipment compartments inside the containment vessel, as proposed for the Pennsylvania Advanced Reactor. These compartments, which are normally never entered during plant operation, must permit ample access for maintenance and replacement operations during shutdown periods. This generally is accomplished by sealing the tops of the compartments with stepped concrete-slab covers which are lifted by means of an overhead crane. Covers may weigh up to 100 tons each.

The interaction between radiation and material results in a transfer of energy which generally heats the material. Near a power reactor core the radiation levels may be so high and changing so rapidly that severe local overheating can occur in structural parts. It is the responsibility of the shield designer to calculate this heating and specify maximum permissible thicknesses and the required thermal shields or other provisions for cooling. Failure to do so can lead to excessive thermal stresses and distortion of structural members.

Accessibility

An important consideration in the design of power reactors is provision for access to the reactor itself, the primary coolant system, and any other portions of the plant located within the containment vessel. Not only must access be provided in the physical sense of hatchways, removable covers, and airlocks, but provision must be made to permit decontamination or deactivation of the atmosphere and equipment so that personnel can enter without suffering radiation exposure. The activity present in the container or its equipment compartments may stem from a number of sources.

Activity may be induced in the reactor coolant during operation. If this happens to be short-lived all that is necessary to gain access to the reactor is to shut it down. If the reactor coolant activity is comparatively long-lived, it also is necessary to drain the coolant from the system, perhaps to flush out the reactor system, and wait for the induced activity to decay.

Impurities may be present in the coolant in high enough concentrations so that their activation attains an intolerable exposure level. This is particularly true with water because of its corrosive nature and the resultant high production of impurities which subsequently become radioactive.

Neutron capture in structural materials of the reactor and its cooling system may result in the formation of radionuclides with long half lives. The steel in the reactor shield is exposed to significant thermal neutron fluxes during reactor operation, and this gives rise to activities proportional to the length of exposure or operating time.

Piping and Valves

Homogeneous reactors, in which the fuel is suspended in the coolant, suffer from circulation of active fission products throughout the primary coolant loop. Valves and flanges present an ever-present leakage hazard. The homogeneous reactor experiment at Oak Ridge National Laboratory used a suspension of uranium and thorium oxides in water. The piping was double-walled with valves and flanges traced with refrigerants to freeze-seal any developing leaks.

Activation of container air also will create a slight problem in delaying access. The activity in the vicinity of a partially shielded reactor (and also in the associated piping in a homogeneous reactor) will produce radioactive Carbon 14 from nitrogen and the formation of Argon 41.

The gaining of compartment or container access depends upon the decontamination plant. The nature of the activity to be removed is established by the particular reactor system, and the decontamina-

tion plant functions follow as an obvious consequence. However, the capacity of the equipment and the quantity of activity it may be required to discharge as unretainable gaseous or liquid waste are items that should be balanced against the cost of plant shutdown time.

Decontamination Plants

In some instances only an exhaust fan may be necessary, whereas in others a succession of filters, absorbers, cold traps, holdup tanks, and other processing steps may be required. This equipment may become activated itself and require its own shielding or remote handling provisions. The decontamination plant must be capable not only of allowing ready cleanup following a normal plant operating period but also following an accident such as rupture of a coolant line or an accidental spillage of active liquid. The problem becomes quite complex if fission products have to be removed, particularly if some are short-lived submicron solids that decay to long-lived gaseous forms.

Decontamination plant equipment differs little from the standard chemical processing plants except for particulate filters. Conventional industrial plants exhaust vent gases through roof-mounted cyclones; power plants employ additional electrostatic precipitators to control fly ash; nuclear plants require so-called absolute filters for active submicron particulates, and stacks as high as 250 to 350 feet to disperse active gaseous wastes. Stack costs of the order of $300,000 are not uncommon.

Remote Operations

With the essential need for shielding in carrying out any work on radioactive materials, a great deal of effort has been devoted to the design of remote control devices for experimental and maintenance operations. Typical examples in a reactor installation are the reactor shut-off and control rod drives, and special transfer techniques for loading and unloading fuel elements.

In addition to simple remote-control drive systems directly associated with reactors, there is a considerable amount of equipment now in operation for handling and processing irradiated material. Typical examples occur in the chemical processing of fuel elements, disposal of waste products, preparation of radioisotopes, fabrication of fuel elements, chemical analyses, metallurgical examinations, mechanical testing procedures, remote welding and cutting, and numerous other precision operations. In designing mechanical apparatus for the remote performance of these tasks, the engineer must be sure that the operation will be performed economically, rapidly, safely, and to as high a quality as if it had been done conventionally by skilled hand labor. The detailed design of the numerous custom-built intricate mechanisms needed to fulfill these requirements hardly can be matched in any of the other process industries.

The economical design of remote operating mechanisms is intimately related to the shielding construction. When material emitting gamma radiation has to be handled, the densest shielding material is required to protect the operator. The thickness of the shield depends on the quantity of radioactive material, its energy, and the nature of the absorber. This may require anything from a few inches of lead up to several feet of concrete. For all but the very smallest quantities of gamma radiation, very dense shielding is necessary, and the added problem of providing viewing devices becomes significant.

Manipulative Equipment

It is in this field of combined manipulative and viewing apparatus that experience, skill, and ingenuity may make a very significant contribution to the successful operation of a facility. Since the choice of handling and viewing equipment depends on the density and thickness of the shield, much controversy exists as to the relative merits of various systems. Generally, tongs are used for handling through lead walls, while master-slave manipulators are used with concrete and other thick-wall construction. Similarly, lead cells require high-density glass for viewing-windows while liquid or laminated glass-plate windows are used in concrete shields.

Lead is favored as a shielding material with remote handling equipment because it takes up a minimum of space, can be cut and altered easily at some future date, and can be readily machined, filled, and cast into odd shapes. Its disadvantages lie in cost, temperature-creep properties, and the problem of accommodating viewing-windows.

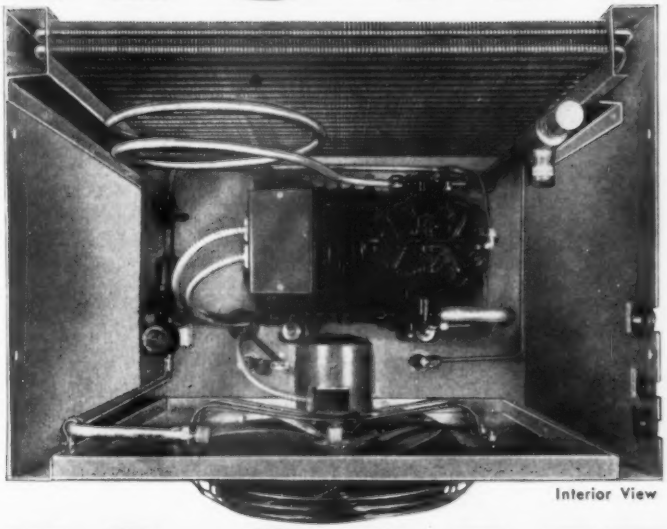
"Through a Glass, Darkly"

Ideally, viewing-windows should match the shielding wall in thickness and protection; this usually can be achieved easily with concrete walls, but, even with very dense lead-glass blocks, windows for lead walls exceed 1½ times the wall thickness. A particular problem in window design is the inherent instability of glass when subjected to radiation. Glasses commonly used in optical instruments, electric light bulbs, and fittings discolor rapidly in high fluxes of gamma radiation. Remote viewing can, in the simplest applications, be more convenient and cheaper to install than direct-viewing systems.

With automatic processes or highly specialized work where a peep hole is the only viewing required, an oblique aperture in the shielding with a suitably positioned mirror on the "hot" side may meet operational needs. Alternatively, open-top cells can be viewed through simple periscope systems. With open-top cells and with apertures through shields, radiation scatter is important, and multiple reflecting systems or combinations of mir-

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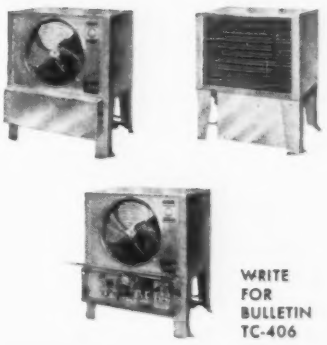
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WRITE FOR BULLETIN TC-406

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TYPICAL REMOTE VIEWING AND MANIPULATION OPERATION DESIGNED BY WALTER KIDDE NUCLEAR LAB.

ror systems and glass blocks, to cut down scatter, may be necessary. The photograph shows remote operation with a periscope viewer combined with master slave manipulators installed at the Continental Oil Company's gamma irradiation facility.

Viewing Problems

There still are many problems. There is the difficulty of discoloration of common optical glass so that provision must be made for the use of cerium-oxide stabilized lenses on the hot side. With monocular systems depth perception is difficult and simultaneous manipulation is fatiguing with fixed eye position. With simple mirror systems the image is inverted, and with rotating mirrors the orientation of the view is altered, all of which may be confusing even to experienced operators and considerably effect productivity and efficiency.

Closed circuit television may be desirable for remote monitoring, but its value in manipulative work is limited by lack of definition and color discrimination. It is, however, a great asset when a temporary cell has to be set up and brought into operation quickly. For certain routine investigations, such as microscopic examination, it may be more convenient to build into the instrument a television transmitter rather than provide a direct optical path. Thus, because of the necessity for a biological shield, all viewing and handling systems must take into account operator inconvenience and should be designed with that in mind. A compromise must be arrived at whereby the operator has sufficient viewing facilities to carry out his operations satisfactorily and yet the system must not be unduly complicated and expensive. Its economics must consider the choice of shielding material and the possibilities of program changes which might require future alterations.

Steel Frame Shields

The disadvantages of thick concrete-wall shielding when future alterations are contemplated can be overcome quite economically in certain instances. An unusual method used at Harwell has been that of providing a series of steel framework sections, approximately 6-ft wide by 3-ft thick and 11-ft high, clad in mild steel sheet; each section is independent but joined mechanically, and can be individually filled with shielding material in loose form — sand, lead powder, steel shot . . . With cells of normal poured concrete construction, later rearrangement of the layout or addition of windows or extensions are usually major operations requiring the use of pneumatic drills and considerable expenditure of time. However, with steel-frames, the particular section requiring modification can be emptied and alterations carried out with much less difficulty. In addition, the loose-form fill material can be varied depending on the degree of shielding required.

The design of remote handling equipment must be approached with a clear understanding of what is required to suit the particular conditions rather than reproduction of a conventional method or selection of an off-the-shelf component. In many remote operations it may not be advisable to carry out the functions in the same manner in which they would be performed under normal conditions. For example, in nonremote manipulation the most common method of transferring small quantities of liquid from one vessel to another is by pouring. In remote manipulation, while such action can be reproduced, a more reliable method of transferring is through the use of suction or pressure lines. Similarly, pneumatic or hydraulic devices often are used in preference to the more conventional screw vice even though a screw vice could be operated with tongs or manipulators.

Custom Matching

The multitude of considerations that enter into the custom matching of a handling system to a specific facility can be simplified considerably and design time reduced by the use of models or full-scale mock-ups. Dummy tong stations, control shafts, and viewing apertures can be moved around at will to establish the most convenient and yet minimum number of widest-range operating positions. The use of models in planning nuclear facilities has been

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found as rewarding as their use in complex piping and equipment arrangement studies in the petroleum and heavy chemical fields.

Plant Layout

A nuclear power plant can be more compact than conventional coal-fired plants. The need for shipment, conveying, and storage is eliminated since one ton of uranium fuel is equivalent to about 130,000 tons of coal. On the other hand, the nuclear plant must provide certain other facilities which, though not as space consuming, nevertheless present important considerations peculiar to nuclear installation layouts.

Whether it be a research facility or a power plant, the functional arrangement should follow the general rules for good ventilation practice in any radioactive installation. There should be a continual positive flow of air from areas of lower to areas of higher activity. To fully accomplish this with one ventilation system would let the entire exhaust issue from the area of highest activity. This is not altogether practical since the area of highest activity, the reactor itself, is so much more active that it is not economical to clean up a large stream of reactor atmosphere. The reactor ventilation system must, therefore, be separate and of lower throughput since it will contain activity in such concentrations as to require decontamination factors of the order of 1:100 million or greater. The cost of processing large volumes of gas in a clean-up system that efficient obviously would be prohibitive. Another factor that limits the simple unidirectional air flow in a power reactor facility is the necessity for keeping oxygen, nitrogen, and water vapor away from the reactor core, particularly with sodium-cooled or other extra-nuclear hazardous systems. By proper arrangement of the areas of different hazard levels in longitudinal or concentric order, it frequently is possible to reduce shielding as well as ventilation costs.

Another factor that must be considered in the plant layout is the flow pattern of plant personnel in the performance of their duties. The preferred arrangement parallels the considerations involved in ventilation; workers enter at the lowest level and pass to areas of successively higher activity. Work in these various areas will require protective equipment of one kind or another such as overalls, boots, gloves, respirators, masks . . . These items should not leave the areas in which they are used except when removed to the laundry, disposed of as radioactive waste (when at too high a level for laundering), or otherwise sent to a decontamination center. Supply and change rooms should be provided at all critical area boundaries, and areas of similar hazard level should be grouped in such a way that all potentially contaminated workers can use the same change room, located the shortest possible distance from their work. Though the provision of some of these conveniences appears at times to be a luxury, it is also a continuing source of savings in the operation of the plant. Fig. 4 shows a typical longitudinal layout for a waste concentrating and packaging plant.

The plant layout, the facilities for material handling, the provisions for convenient maintenance, and the capacity of the decontamination plant to permit access, all contribute to the economics of efficient plant operation.

Time may be well spent in discriminate selection of operating personnel. This is important not only from a hazards point of view but also in on-stream time, since a careless spill of radioactive material during a maintenance operation can be quite costly. The selection and training of responsible workers must provide for education or elimination of the over-confident, the careless, and the worrysome. As in any industrial plant, safety and efficiency depend on the over-all training and vision of designers and operators alike. ♣♣

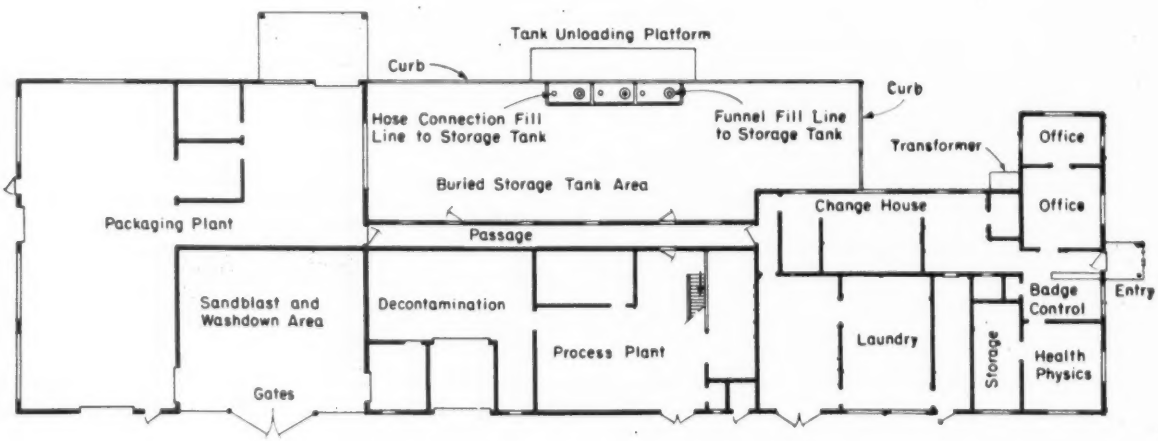
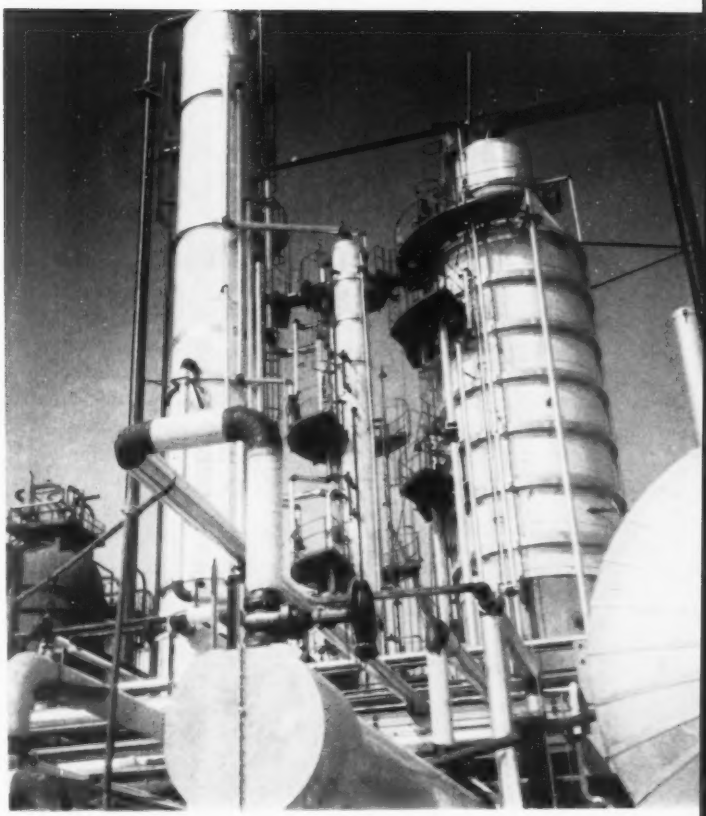


FIG. 4—LAYOUT OF A TYPICAL WASTE CONCENTRATING AND PACKAGING PLANT FOR AN ATOMIC INSTALLATION.



LALE CLARK ANDREWS

Lale Clark Andrews received his degree in mechanical engineering from Kansas University in 1922. From the time of graduation until 1934 he worked as a designer of oil refineries and chemical plants. In 1935 he joined the M. W. Kellogg Co. in their piping department, with emphasis on stress analysis of high temperature piping. In 1940 he developed and directed the Kellogg Pipe Testing Laboratory, and last year he purchased this laboratory from M. W. Kellogg and established his own practice in New York City and at the laboratory at Stella, Nebr. He is the author of a number of papers and articles on piping stress analysis, and is co-author of Design of Piping Systems, published by John Wiley & Sons.



Analyzing Complex Piping Systems

WORLD WAR II brought important changes in the design of piping systems. Vastly expanded gasoline production brought the catalytic cracking plant to sudden maturity, and with it came a new labyrinth of large diameter, high temperature piping. Also, the increased demand for power highlighted the economic virtues of the high pressure steam plant.

In both of these fields, refining and power generation, the proposals of the process engineers grew bigger and hotter; and as piping sizes and temperatures increased, so did the problems of the equipment designers. Materials became an issue. Carbon steel pipe was unsuited to the higher temperature services; its successor, carbon moly, gave way to chrome moly and chrome nickel. Corrosion, erosion, end reactions, and stress became familiar terms.

It had been the custom of turbine manufacturers as late as the early forties to specify zero thrusts on inlet and outlet nozzles. This convenient absurdity permitted individual consideration of each proposed steam line and gave the manufacturers an unrestricted veto power if it was felt that the submitted flexibility analysis did not offer an adequate representation of possible end reactions. A turbine was even then an expensive item, and the manufacturer who accepted responsibility for its satisfactory operation felt within his rights in demanding more flexible piping where there was any question of damage to his equipment.

Mathematical Development

By this time the analytical theory of piping flexibility analysis had reached a state that justified greater confidence, and the metallurgists were expanding their knowledge of alloy characteristics and welding techniques. As a problem in flexibility and stress, the piping system was boldly approached as a general case of the redundant frame in space. Most of the intricate interrelations of its many members in any combination of configurations, materials, and temperatures were painstakingly cataloged in a set of simultaneous equations that could be expanded to encompass any piping problem. Limitations of time and computing facilities did, however, handicap the use of this powerful mathematical development, and where the intricacy of the problem made a mathematical solution infeasible, analysts turned to the more direct approach of scale model testing.

Piping design and layout as a branch of engineering grew, in its earlier stages, through the sporadic

efforts of individuals and organizations to correct difficulties that were giving immediate trouble—leaking flanges, worn turbine shafts, or jammed pumps. As these problems became better understood, the lack of knowledge in associated fields became more apparent. The manufacturers of equipment to which piping was connected became cognizant of the importance of solving the problems peculiar to the piping as an entity, or, at least, of predicting those effects that might impair the operation of the portion of the plant for which they were responsible. As a result, general concepts of piping design and engineering are now reasonably familiar to most engineers engaged in process plant layout.

Design Procedure

At its inception, a piping system consists merely of a few diagrammatic vectors on a process flow sheet, indicating that material of a given characteristic and in a given quantity is to be moved from one place to another at a given rate. The engineering flow sheet, prepared as the next step, indicates those features of the piping design that are essential to the operation of the plant, including the sizes of the various branches of the piping and the diagrammatic locations of valves. Also included on this drawing, or in the specifications accompanying it, are the wall thickness of each run of pipe, its chemical composition, specifically designated valves, flanges, fittings, and bolts that are to be incorporated in the system, and a detailed account of the welding procedures and materials employed in joining the parts. Much of this information is given in symbols which refer to the various codes of standardization.

The usual design procedure is to lay out the shortest pipeline that will perform the required function and can be conveniently supported from existing structures. The resulting configuration is checked for adequate flexibility and modified, if necessary, to reduce internal thermal stresses in the pipe or end reactions on equipment. Where the pipe is obviously sufficiently flexible, the analysis may be merely a visual one. Unfortunately, the inadequately trained man often can make favorable decisions on the basis of visual inspection with greater confidence than can the experienced analyst. This facility is sometimes misleadingly described as the "ability to make decisions." Unfortunately, these decisions by the brave but inexperienced are all too often wrong.

Increasingly Important

The pipe stress analyst often is seen as a harbinger of bad tidings. Actually, most pipelines are satisfactory stresswise, but the ones that are not are more memorable because they are more costly and troublesome. If some small change will set them right, they quickly fade from memory, like the motor car that almost hit us. But if they require a serious redesign at a time that delays construction, the analyst is apt to find himself a lonely speaker before an unfriendly audience.

Yet, this work is becoming increasingly important, and the analyst cannot afford to compromise with safety. The main steam line of one of the most advanced power plants now under construction will cost nearly $2 million. No company can afford to make an installation of this magnitude without careful engineering. The heavy-walled stainless steel piping must be forged and bored; every inch of every weld must be as perfect as modern welding technology, welding skills, and testing techniques can make it. Each weld will require a week's work.

Since every foot of this pipe will cost nearly $1000 erected, none can be wasted in unnecessarily large expansion loops or other excursions that might give the designer a comfortable feeling of security. The pipeline must follow as direct a route as safety, operating requirements, and the physical layout of the plant permit.

Unfortunately, no comprehensive criterion has yet been established that can be used as a dependable advance guide in designing a complex piping system for both economy and adequate flexibility. As with all structures, a design is first assumed, then checked for adequacy. Subsequent decisions are based on necessity, available time, and economy.

The Purpose of Analysis

In general, the flexibility analysis of a pipeline or system of interconnecting lines subjected to thermal expansion performs three functions.

- It determines the forces and moments the expanded or the cold-sprung line will exert on equipment to which it is connected.
- It determines the stresses that will be set up in the pipe itself.
- It describes the path of displacement that any selected point on the line will travel as the pipe expands or is cold-sprung.

A well designed pipeline, structurally speaking, has an evenly distributed stress pattern throughout its length; economy of material is represented by a fairly high though safe stress; and the end reactions are comfortably within the limit set for connecting equipment. Supporting structures and mechanisms are designed and located to assure maintenance of the pipeline's original configuration within customary but, at this stage, undefined limits.

Hanger Adjustment

After continued operation at a high temperature, a line often relaxes and redistributes the weight load on the various supports, lifting off some springs while forcing others to the limit of their travel. It has become customary in many plants to correct this condition by checking and readjusting hangers every 6 to 12 months. At present, our only criterion

for acceptable permanent deformation is that the line continue to perform its function satisfactorily and show no evidence of damage that might result in failure.

Recent sales efforts on the part of competing companies have tended to confuse many engineers regarding the true relative merits of various methods of piping flexibility analysis. In truth, none of them offer a perfect solution of the general piping problem. Before expanding on this statement, it is important to distinguish between a theory of analysis and the means of accomplishing the analysis. The degree of validity of the theory is vital to the correctness of the solution. The means of carrying out the solution is merely a matter of convenience and speed. Speed of solution is economically important, but a fast, incorrect solution is no help. It is not what can or might be done that determines the accuracy of the results, but what actually is done.

The Perfect Analysis

There is only one "perfect" analysis. That is a series of full-scale tests on the actual piece to be used, under operating conditions, and employing instruments of sufficient scope, range, and accuracy to give the engineer the information necessary to establish the adequacy of the pipeline. This extreme procedure, if actually performed, will avoid nearly all of the possible surprises lurking in the various theories, tacit assumptions, and long-time beliefs that are part and parcel of most analyses. This statement is not intended to throw sand in the eyes of the designer of familiar types of piping but to remind the mathematical analyst that he is working with theories and generalizations based on many, but not enough, experiments. These theories and generalizations do not always apply to the conditions at hand. Engineers working on advanced creations must evaluate the results of analysis only after considering the accuracy of the mathematics employed in obtaining them. It is not possible to extrapolate the curves and formulas in the handbooks with any great confidence.

All other analyses of whatever sort are but approximations of full-scale testing, an approach that actually is being pursued in a few highly critical projects. The usefulness of the method is sharply limited by its great cost and the engineering difficulties involved in designing and installing equipment that will yield the required information. Many of the instruments at the engineer's disposal have limitations, the significance of which may not be clearly apparent to him until he uses them. A familiar example is the great difficulty of obtaining accurate force and strain measurements at high temperatures.

Some of the knottiest problems of the full-scale test are more easily solved if a scale model is substituted for the larger prototype. The magnitudes involved fall within the ranges of accurate and available instruments; the smaller dimensions reduce the cost of almost every item of equipment and greatly facilitate control of the various experimental factors. Where a true, scale model of a piping system can be fabricated, with all design and operating factors correctly reproduced, and where instrumentation of sufficient scope, range, and accuracy is available, the scale model test offers a method of analysis second only to the full-scale test. In its revealing exploration of the interactions of the various members, it can be made about as exhaustive as desired.

Tubing Models

Unfortunately, economic factors also limit the employment of the perfect model test. In the course of routine analyses, simplifications are introduced in the interests of speed and economy where, in the judgment of the analyst, assurance of the satisfactory operation of the system will not be jeopardized. The validity of his judgment depends on his understanding of the significance of each of the factors that influence the final results of the analysis. The analyst cannot afford to relinquish a factor merely for the sake of convenience or speed without a clear understanding of that factor's influence on the end results.

A single-scale tubing model of a piping system whose curved members are carefully formed and which is subjected to the operating conditions of the piping reflects all of the flexibility characteristics of the prototype insofar as every dimension is exactly proportioned. All members, straight and curved, have the same relative bending and buckling, tension and compression, and stress and strain characteristics as their full-sized counterparts. This means that the theory of the single-scale model test is valid when the moduli of elasticity, particularly at elevated temperatures, are known.

Critical Applications

In actual practice a model would be employed only for the most critical applications where fundamental information was being sought. In routine tests of power plant, oil refinery, and chemical piping, solid rods of proportional stiffness usually are substituted for tubing, which is often difficult to obtain in correct wall thicknesses. Curved member flexibility factors close to unity are ignored; those of higher value are sometimes represented by special fixtures that introduce the flexibility factors prescribed by theory. Ignoring the flexibility factors altogether gives high end reactions — on the safe side. Where there are many weld ells in a line, however, their flexibility and stress intensification factors should be taken into account.

While it requires ingenuity to devise an effective model test, a mathematical development that yields

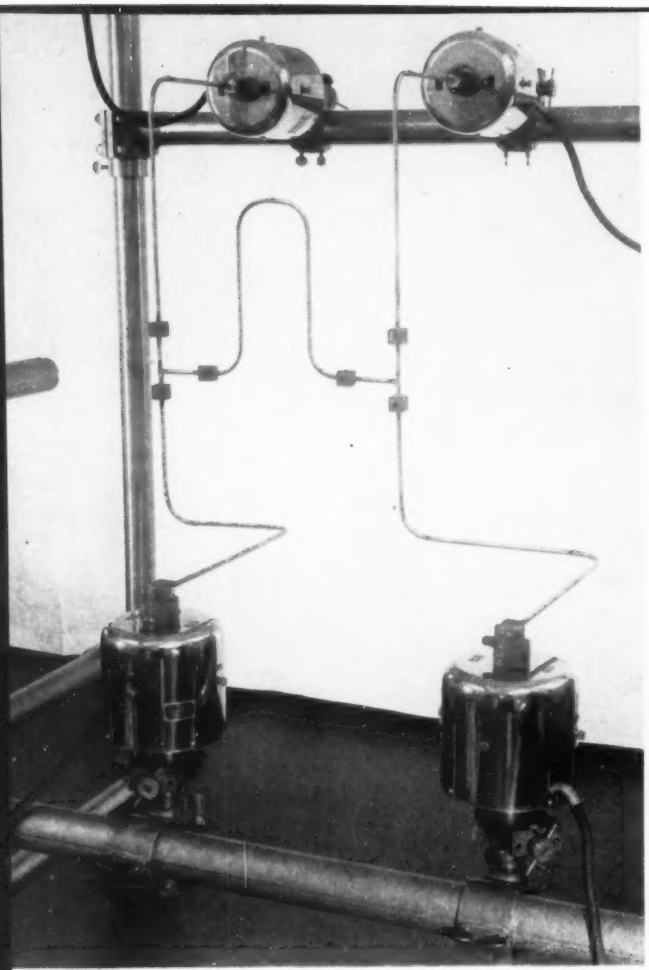


FIG. 1—FLEXIBILITY ANALYSIS OF THIS STEAM SYSTEM COULD BE HANDLED WITH ABOUT EQUAL ACCURACY WITH EITHER DESK OR ELECTRONIC COMPUTERS OR MODELS.

the same results is even more difficult. Every significant characteristic of every member of the piping system must be represented by a symbol. Operations representing the multiplicity of physical interactions then must be performed on these symbols.

Secondary Structural Effects

The mathematical methods of flexibility analysis in common use do not take into account the buckling effect of long lines, all members being treated as beams only. The theoretical flexibility factors of curved members (or the Piping Code simplifications of them) customarily are employed, but certain so-called secondary structural effects often are ignored. These inherent theoretical errors, which are of different degrees of importance in different layouts, generally may be considered of minor importance in comparison with the arbitrary simplifications of configuration so often made to reduce computing time.

Automatic computers, which have greatly increased the speed of computation, and thus the magnitude of the problems that can be feasibly undertaken by mathematical methods, have reduced the tendency to simplification, but have by no means eliminated it. The automatic computer is a powerful tool for the solution of large numbers of complex problems, but a measure of judgment must be employed in order for it to achieve its greatest effectiveness. In general, it does not yield more accurate results than a manual computation, and many simple problems that could be solved just as accurately and more economically by desk calculators now are being fed into automatic computers. Many complex problems can be solved more comprehensively, more accurately, and more economically by model test..

A Matter of Availability

The choice between the mathematical and model test methods often has to be made on the basis of availability of model testing equipment and of adequate computer programming — a tedious and expensive procedure with general purpose computers. The model test laboratory was conceived as a means of solving the more difficult problems with accuracy and speed, and there are still layouts, some of them too individual to be generalized, for which no computer has been programmed. The complex structural effects of the terminal elements of superheaters and reheaters still are more comprehensively and conveniently represented in the scale model where they can be economically reproduced in all their variety and intricacy of configuration.

In an unsymmetrical array of superheater tubes, the common mathematical representation of the entire tube complex by a single pipe, of whatever moment of inertia, gives scant information concerning the stresses in the end tubes. In these layouts it is likely that the tubes on one end will be

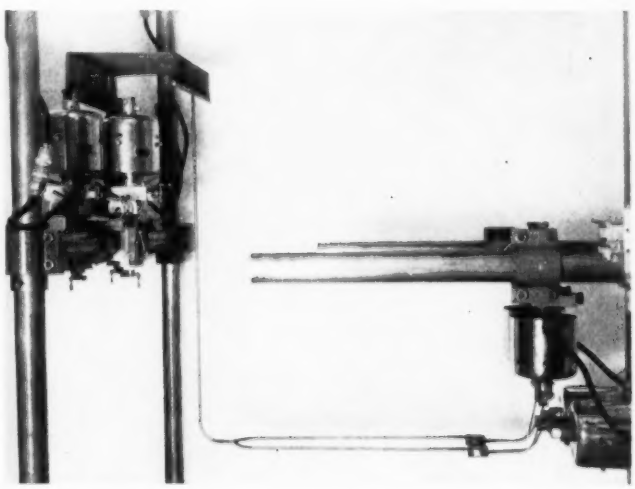


FIG. 2—SYMMETRICAL MAIN STEAM SYSTEMS LIKE THIS CAN ALSO BE HANDLED SATISFACTORILY BY ELECTRONIC COMPUTERS OR MODELS BUT NOT BY DESK COMPUTERS.

much more highly stressed than those on the other end. The experimental designs for some of the more advanced equipment present problems that probably will not occur often enough to justify the heavy expense of programming a computer. Others, involving exceptionally high temperatures, are of such a nature that characteristic design data is not readily available, and the hot model test offers the only safe and economical method of solution. Model test equipment has been and is being developed to give this method greater flexibility and range in the new fields and greater economy in the old.

Systems Illustrated

Four different scale model setups for high temperature steam line designs for major central station installations are illustrated. The system shown in Fig. 1, the simplest of the four layouts, though actually model tested, could readily have been solved with equal accuracy either manually or by electronic computer. The most formidable part of the manual computation would be the solution of the 18 simultaneous equations, which could be accomplished in approximately a working day by a skilled desk machine operator. The choice of means in solving a problem of this type can be made entirely on the basis of what skills and what equipment or programming are most readily available. If another

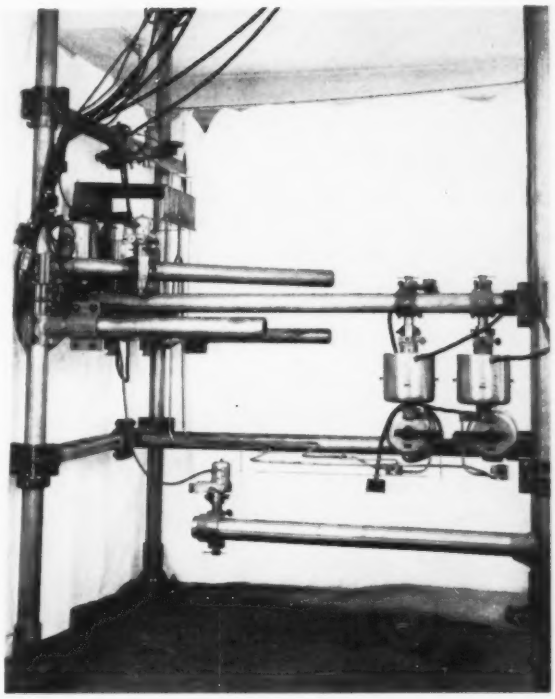


FIG. 4—COMPLETELY UNSYMMETRICAL SYSTEMS CAN BE SOLVED BY MATHEMATICAL COMPUTATION BUT ARE MORE ECONOMICALLY HANDLED BY MODEL TESTING.

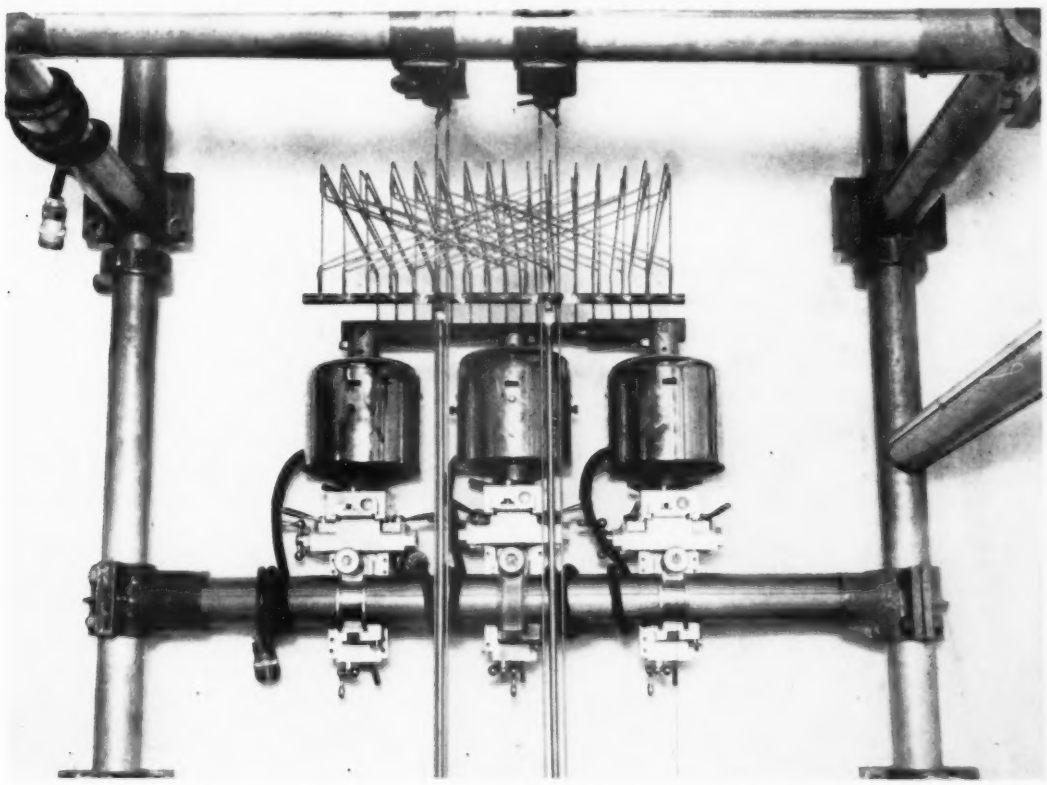


FIG. 3—SYMMETRICAL BUT INTRICATE PIPING SYSTEMS CAN BE HANDLED MORE EFFICIENTLY BY TEST MODELS.

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branch were added to the system, the manual solution would be economically though not technically disqualified.

More Complex System

Fig. 2 shows a much more complex system which because of its symmetry could justifiably be simplified for solution on an electronic computer. This simplification, which still would leave a problem somewhat too laborious for practical manual solution, would consist of substituting a single imaginary pipe of correct moment of inertia for the many superheater terminal elements between the boiler roof and the horizontal header at the top of the riser. This substitution is permissible because, except for minor effects, all of the terminal elements will be subjected to a single moment and equal stress. The validity of the substitution actually would depend somewhat upon a number of design details which have been omitted for simplicity.

Not all symmetrical layouts can be justifiably simplified for computer solution, however. Fig. 3 illustrates a tube complement that no single pipe substitution could possibly represent. Technically, the problem is solvable in its entirety by electronic computer if the necessary program is available, but a model test would be by far the most economical solution. The model analysis has the advantage of being able to determine the end reactions and stress pattern in any branch of a piping system without solving the major part of the entire problem. This is not true of any mathematical solution. Hence, in the complex design illustrated, each tube (or typical tube) can be isolated quickly from the others and its end reactions measured while it and all the rest are contributing their correct structural effects. Equipment is available for facilitating this operation.

Unsymmetrical System

Fig. 4 shows a completely unsymmetrical high temperature reheat system. The turbine axis is perpendicular to the center line of the boiler, and there is an offset in the piping. Substitution of a single pipe for the bank of reheater tubes would result in an untenable solution, since the different tubes are subjected to a wide variety of moments. It can be justifiably assumed, however, that sample reactions measured at the end tubes and at the middle tubes will yield the extreme values that will occur at the tube ends and the maximum stresses in the tubes. Hence, the stresses in all other tubes, though unknown, will lie below these maximum values. This problem technically can be solved in this same manner by automatic computer, but economics are on the side of the model test.

On the other hand, the automatic computers are becoming progressively more useful and have made feasible mathematical solutions that formerly were totally impracticable. Additional developments in the smaller computer field will tend to fill the gap between the large computers and the desk machines. Though they will cause a shift in the work load, present indications do not suggest that new developments will soon supplant either the desk computer or the model tester. The various approaches to the general problem are mutually supplementary even though overlapping in their scopes. No one of them is sufficiently comprehensive, both technically and economically, to eliminate the need for the others. In fact, an inexpensive analog computer, specifically designed to solve a large class of simple layouts, would be a serviceable addition to the family, and a special purpose digital computer with the requisite features likely would find an immediate market.

Experience and Comprehension

Whatever means of solution are employed, it is apparent that the results will reflect only those effects that are represented adequately in the method and only those factors that actually are included in the input. This fact too often becomes a little blurred in the course of discussion of the relative merits of the various methods. Since no method is perfect, the most important factor in any analysis is the experience and comprehension of the engineer who sets up the problem and interprets the results in the light of the accuracy and completeness of the input data, the scope and shortcomings of the method employed, and the origin and significance of each of the factors involved.

Competent designers of central power station and oil refinery piping are sufficiently aware of the problems involved to avoid most of the actual design errors. However, an occasional error still occurs, and errors are much more frequent in the new and unorthodox designs of nuclear equipment where special considerations often prevent the designer from taking unusual precautions to ensure flexibility.

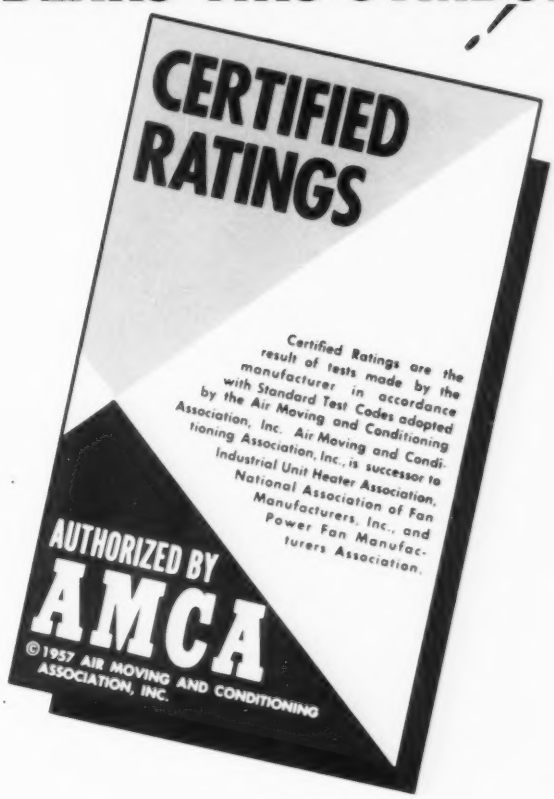
Preferred Practice

An example of preferred practice can be illustrated in the arrangement of boiler and turbine in a power plant. Though other considerations well may overshadow that of optimum design for flexibility, experience has indicated that satisfactory end reactions and stresses are most readily and most simply achieved where the turbine axis is continuous in plan with the boiler center line. Then it is possible to lay out all major lines between boiler and turbine in symmetrical designs. This arrangement, as shown in Fig. 2, usually avoids the necessity for stops other than rigid hangers, and corrective measures for any overloads or overstresses that may occur are usually obvious.

A more detailed examination of this system reveals other design features that have proven use-

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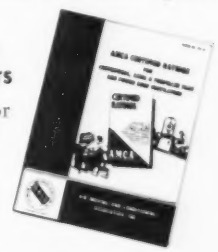
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ful elsewhere. The high rise and long horizontal run of the superheater terminal elements and the L-shaped design of the turbine leads give adequate flexibility at these critical locations. A rigid hanger would be attached to the single riser at the point of zero vertical deflection to support the weight of the riser and stabilize the line against vibration. This hanger could be raised or lowered to redistribute the end reactions if necessary.

Variations in Design

The design is subject to many variations in proportions and details, but any structural inadequacy that analysis reveals can be easily and economically corrected. The Z-shaped design is less flexible than an L-shape of the same over-all dimensions would be, but it is more adaptable to the contours of the typical generating station.

With unsymmetrical layouts it is often necessary to make several trials in placing stops. In an intricate system a stop that will correct one undesirable condition will sometimes create another. Limit stops, which offer a solution to many problems, are not allowed full credit by at least one major turbine manufacturer. This kind of cut-and-try engineering is expensive, but not as expensive as the design changes that often are unavoidable.

Potential Troublemakers

Many design details have become identified as potential troublemakers. A few have recurred often enough to make them noteworthy. For example:

' Stops placed close to points of fixation cannot be relied upon to function fully in accordance with the theoretical implications of their positions.

' Intermediate rigid restraints, closely spaced, generally do not function as expected. Usually one of them carries more than its share of the load while its neighbor is slack. A frequently observed example is the employment on power plant piping of a rigid hanger on each of two closely spaced risers that are tightly joined at the top. One of the hangers invariably bears the total load as the result of a slight tilt of the risers from the vertical. The solution is often a rigid hanger on one riser and a spring hanger on the other.

' Small diameter branches connecting with large lines present two undesirable possibilities. If the small line is short and stiff, it may suffer damage from an excessive deflection of the larger pipe, or it may restrain the large line sufficiently to cause spring hanger trouble or some other distortion. Designers usually try to connect these branches as closely as possible to locations of small deflection, but they do not always recognize how flexible the branches need to be when connection is made at a more sensitive point on the large line.

' Size reductions in large hot lines nearly always should be checked thoroughly for excessive stresses.

' Piping that is highly critical to extraneous end displacements can be a serious danger that is not always easily recognized. Such a system has been shown to vary from satisfactory to severely overstressed with an assumed variation of one-hundredth of an inch in the nozzle movement of a large vessel to which it was attached — a narrow margin of safety that could be offset by a slight change in temperature. This sensitivity would not have been discovered had the line been model tested only for the vessel manufacturer's estimated movement of the nozzle, an estimate that is often an educated guess, rounded off to a reasonable fraction of an inch.

' Complex systems subject to many variations in operating temperature all too often are analyzed only for an assumed "worst case." This practice saves time and original engineering cost, but the fallacy hardly needs comment.

Short Elements

Certain so-called piping systems are not really piping, according to the usual concepts on which the theory of flexibility analysis is based. A piping system is analyzed mathematically as a geometrical line of given stiffness located at the neutral axis of the pipe. The stress at any cross section is determined by dividing the resultant moment at that location on the axis by the section modulus of the pipe and multiplying by an additional factor at points of stress concentration.

It is assumed that local yielding will result in relief and redistribution of moderately excessive local stresses. It seems apparent that this theory is most applicable to lines of considerable length in relation to diameter. It becomes progressively less applicable as this relationship reverses. Where the piping system is an 8-in. tee or lateral with a few inches of pipe welded to its ends, the molecules still can redisperse themselves, but their range of freedom is curtailed greatly. And where the major thermal deflections of a piping arrangement also are constrained to a given path, the system becomes little more than a fluid conducting mechanism with short tubular elements. It ought to be analyzed accordingly. These designs on highly critical projects become dangerous when treated as piping systems.

Special Considerations

Recent proposals concerning welding for inclusion in the Piping Code recognize variations in importance of different classes of installations. A similar consideration might well be given by every analyst in comparing his determined values with allowable stress ranges. All of his initial assumptions and simplifications should be re-examined in considering the validity of his results. Special consideration should be given to piping that presents unusual danger to human life, that is especially costly to replace, or that is exceptionally stiff. ▲▲



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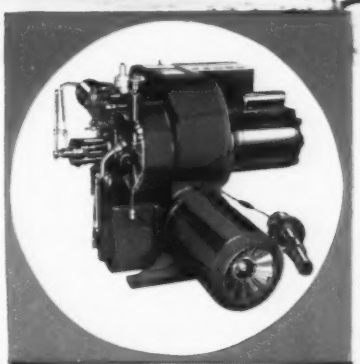
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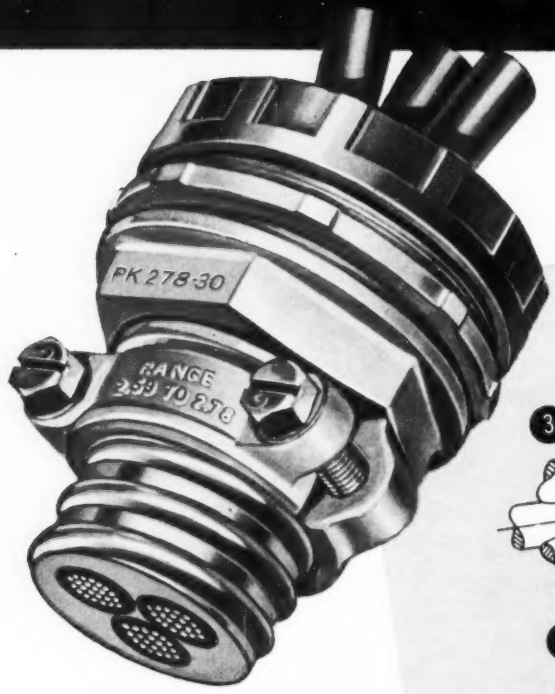
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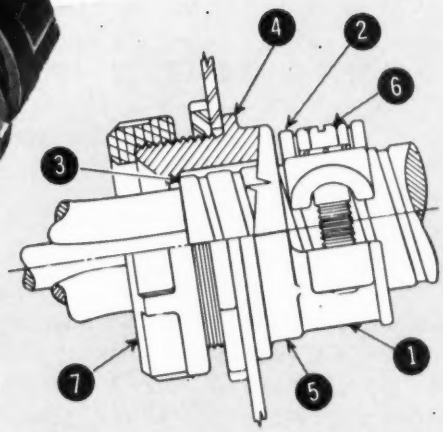
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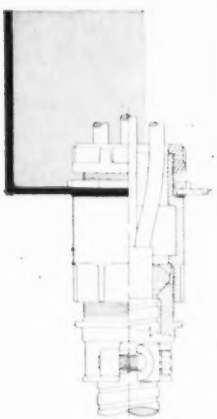
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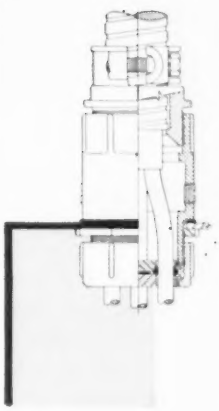
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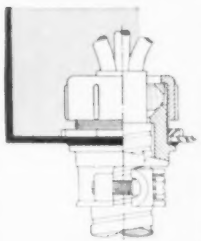
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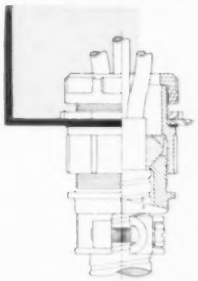
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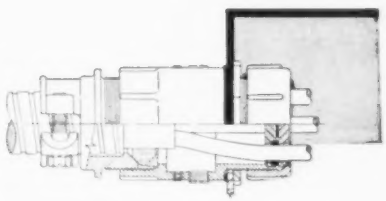
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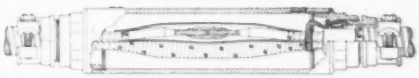
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Consulting Engineer's Vienna Correspondent analyzes the Soviet Science-News policy from the A-Bomb through Sputnik II and tells what we can expect in the months ahead.

How Russia Releases the News

RUDOLPH SOBOTKA
Consulting Engineer European Correspondent

exclusive

PAST EXPERIENCE has taught the West that War and Peace in Communist jargon are not, as is commonly believed in the free world, mutually exclusive terms, but interchangeable words to be used as policy dictates. One of the major theses that the Soviet government sought to maintain after the War was that in the Soviet Union atomic energy would be devoted solely to peaceful uses.

This fable seemed to blow to pieces when, on September 23, 1949, the United States, British, and Canadian governments announced that, according to data at their disposal, an atomic explosion had taken place in the Soviet Union. The Soviet government was taken off guard by the announcement, and realizing the contradiction inherent in the knowledge that the Champion of Peace was manufacturing atomic bombs, the Kremlin decided to assure the world that the only use being made of atomic energy in the Soviet Union was in the field of peaceful construction. Two days later, therefore, the official Soviet news agency *Tass* announced that though the USSR possessed the secret of the atomic bomb, this knowledge and skill were being used exclusively for such activities as the "blasting of new paths for the diversion of rivers."

The Soviet Union also kept silent when she had carried out her second A-bomb test, which was announced first by the United States, on October 3, 1951. This policy of keeping from the world the news about her A-bomb tests, and her protestation of developing atomic power for peaceful purposes only, is characteristic of Stalin's dictatorship.

The Hydrogen Bomb

The exploding of Russia's hydrogen bomb was announced in quite a different way. In a cryptic remark, Georgiy Malenkov, the successor to Stalin, told the USSR Supreme Council, on August 8, 1953, that the secret of producing the hydrogen bomb was known to Soviet scientists. Less than two weeks later, on August 20, 1953, the Communist Party



TOP LEVEL POLITICIANS ANNOUNCE MANY OF THE IMPORTANT RUSSIAN SCIENTIFIC DEVELOPMENTS.

organ *Pravda* informed the world that the first explosion of a Russian hydrogen bomb had been made in the Soviet Union.

Having overcome the U. S. lead in H-bomb development (the U. S. had tested her first H-bomb in the autumn of 1952), the Soviet Union apparently saw no further reason for holding back this scientific news. Her pride must have outweighed her desire to keep on posing as the leader of the world-wide peace movement. Then, too, weapons in the hand of the Soviet Union are "weapons of peace," or, as the Czechoslovak newspaper *Zemedelske Noviny*, of August 21, 1953, put it, "The hydrogen bomb, like the atom bomb, from a curse becomes a blessing in the hands of the Soviet people."

The East German commentator Egbert von Frankenberg made the following remark over Berlin Radio on May 2, 1957: "In the Soviet Union only that is displayed which is ready for use, solid in construction, and has been tested thoroughly." This conscious praise of Soviet public relations policy is actually an unconscious admission of the weakness of totalitarian regimes. It concedes that dictatorships cannot afford to admit publicly mistakes, setbacks, or failures. Mistakes seldom are permitted as part of the ideology.

Adherence to the test-first-announce-later maxim is illustrated by the way the Soviet Union announced her first atomic power station. On April 8, 1954, the Soviet Army paper *Red Star* told its readers that "prospects for the use of atomic energy for peaceful purposes are especially grandiose in our socialist society." This implication was backed up promptly by the USSR Council of Ministers' announcement, broadcast by Moscow Radio, on June 30, 1954, that the first Soviet atomic power station had begun working on June 27, 1954. It was producing electric current "for industry and agriculture in the neighboring region." The location of the plant was not revealed. Its capacity was given as 5000 kw.

On January 23, 1955, the first pictures of the power station appeared in the Moscow *Pravda* but were refused to foreign newspapers and news agencies. Western correspondents were allowed the first glimpse of the "marvel of Dubna" only on September 28, 1956.

This example is noteworthy for two reasons. It is safe to assume that prior to the announcement of its existence, the atomic power station had been



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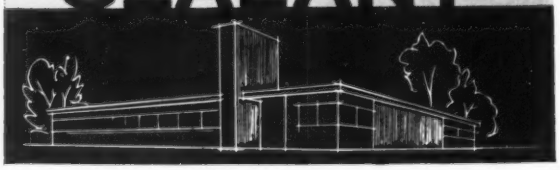


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in operation for at least three months. When the Kremlin leaders had been sufficiently convinced that Dubna would not compromise them in the eyes of their subjects, a few initiated were advised to prepare the population in such a way that the announcement of the big news would become tantamount to a hymn to the regime. This effect was achieved by stressing the tremendous possibilities of atomic power stations and by suggesting that only a leadership that wants the best for its people could accomplish such projects.

Then, by releasing facts concerning the Dubna station not all at once but piecemeal over a long period, the Soviet Union attempted to keep alive the world interest in her first atomic power station.

Guided Missiles

The Soviet people were told for the first time on February 15, 1955 about the nation's development of guided missiles. The news appeared in the Soviet Army newspaper *Red Star*. The paper claimed that the USSR had the equivalent of the United States "Nike" designed to shoot down planes. It also stated that they had developed other new types of anti-aircraft rockets.

The first reference to Russia's intercontinental ballistic missile was in Premier N. Bulganin's appeal on December 29, 1955, in which he demanded the outlawing of atomic weapons "including rocket weapons which recently have been developed into weapons of intercontinental power." Since then, rockets and ICBM's kept cropping up in Soviet news media. Each time some new aspect was stressed which, in retrospect, seems to have corresponded with the actual stages of rocket development.

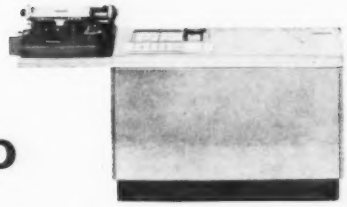
On February 18, 1956, Marshal Zhukov emphasized the existence of "powerful rocket and jet armaments of various kinds, including long-range rockets." Six days later, Marshal Sokolovsky disclosed in *Pravda* that Soviet Armed Forces were equipped with atomic and thermonuclear weapons as well as with long-range rockets. The range of Soviet rockets was underlined when Khrushchev asserted during his stay in England, on April 19, 1956, that guided missiles could cover the Moscow-London distance "in several minutes."

Release Through China

An intimation, that the Soviet missile strength was at least equal to that of the United States was made by Moscow Radio, on February 15, 1957. A couple of days later, a Chinese broke the news that the Soviet Union was in possession of an intercontinental ballistic missile. Cheng Chien, a former Nationalist Chinese General who had defected to the Communists, told a press conference in Changsha, in his capacity as governor of Hunan Province, that the Soviet Union had an ICBM capable of bombing U. S. cities from China. Cheng declared

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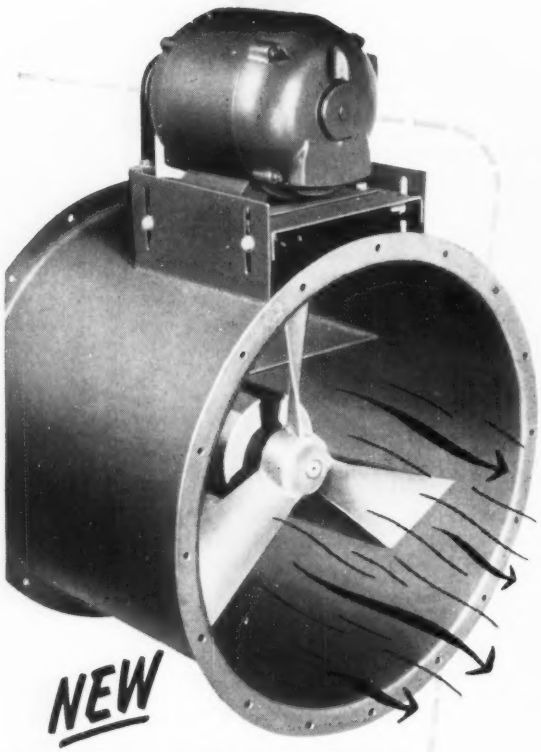
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he had seen a film of the new missile in action during a visit to Moscow. On March 7, 1957, Radio Volga told the Soviet Forces in East Germany that the "camp of socialism" was in possession of the most powerful nuclear and rocket weapons and could smash any combination of "imperialist forces."

On May 28, 1957, *Tass* quoted Marshal Zhukov as saying that the bases around the "socialist world" had lost their former importance as a result of the emergence of various powerful and "accurate" rockets. In November 1957, Professor V. Poyedonostsev and K. Malyutin reported, "The flight, this August, of a Soviet intercontinental ballistic multistage rocket was carried out at a height not reached hitherto by any flying machine. Having traversed an enormous distance, the rocket landed some time afterwards in a predetermined target area."

The Soviet Union hardly can be blamed for having been niggardly of news concerning her rocket development. The same holds good for the artificial satellites. When the Soviet Union finally officially announced the shooting into space of an artificial earth satellite, the world was stunned with surprise. Yet this project was probably one of the most advertised in the whole history of Soviet news policy.

Chronological Survey

A chronological survey of the reports that lead to the announcements of Sputnik I and II on October 4 and November 3, 1957 may prove the point.

January 9, 1954: Vechernaya Moscva reports the founding of an Aeronautical Department of the Moscow Chkalov Central Air Club to popularize achievements of Soviet scientists in the field of interplanetary travel. A. N. Nesmeyanov, president of the USSR Academy of Sciences; declares that artificial satellites are feasible.

March 23, 1954: "Make sure the first man to reach the moon is a Russian," declares 90-year-old scientist A. Obruchev over Moscow Radio.

July 1954: According to most conservative estimates, an artificial satellite of the earth will circle the earth by 1965, predicts V. Dobronravov, Deputy Chairman of the Scientific-Technical Committee of Cosmic Navigation, in *Technics for Youth*.

August 13, 1954: Interplanetary space ships are claimed as a Russian invention. K. Stanyukovich, Doctor of Technical Sciences, declares in *Red Star* that the world's first design of a cosmic space machine was by the Russian revolutionary N. I. Kibalchich (1854-1881, project submitted allegedly in 1881), that the first genuinely scientific design was worked out by the Russian K. E. Tsiolkovsky (actually a Pole by birth, 1857-1935, design allegedly published 1887), that the first liquid-fuel rocket, constructed by M. K. Tikhonravov, was launched in 1933.

September 25, 1954: The Presidium of the USSR Academy of Sciences institutes the Tsiolkovsky

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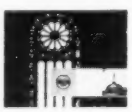
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Gold Medal for oustanding work in the field of interplanetary travel. The height reached by Soviet rockets is said to be 240 miles.

April 17, 1955: The Astronomical Council of the USSR Academy of Sciences sets up a permanent Inter-Departmental Commission for Interplanetary Communication, which is to act as an over-all coordinating body.

June 5, 1955: Modern rockets already are reaching altitudes of more than 250 miles and distances of several thousand miles, says *Soviet Fleet*.

December 8, 1955: Experiments carried out on humans have confirmed the possibility of interplanetary flight, says Moscow Radio.

January 4, 1956: Professor Alexeiy Pokrovsky, interviewed by the East German news agency ADN, declares the USSR is going to launch an artificial satellite during 1956. He mentions two methods developed by Soviet scientists:

¶ The satellite could be ejected from the carrier rocket. (This method was used for Sputnik I.)

¶ The third stage of a three-stage rocket would be the satellite which would move at a speed of 4.97 miles per second. (This method was used for Sputnik II, and it has a speed of 4.97 miles per second.)

March 6, 1956: "The time is not distant for creation of an artificial satellite of the earth," declares Moscow Radio. The first such satellite, the broadcast says, will probably weight 110.2 lbs. (Sputnik I weighed 182.9 lbs.), measure 15.7 to 23.6 inches in diameter (22.8 inches), reach an altitude of about 300 miles (558.9 miles), and revolve around the earth in 95 minutes (95 minutes).

March 1957: The first pictures of dogs in space suits that were rocketed to a height of 68.3 miles and parachuted to earth, appear in the Soviet press.

August 31, 1957: Moscow Radio announces the USSR's intention of launching a series of artificial satellites during the International Geophysical Year. These will differ in design and purpose.

September 17, 1957: Professor Vladimir V. Dobronravov declares over Moscow Radio that very soon, next year at the latest, the first artificial satellite of the earth will be launched.

October 4, 1957: *Tass* reports the successful launching on October 4, of the first artificial satillite.

October 8, 1957: The scheduled launching of a second artificial satellite on the occasion of the anniversary of the October Revolution, celebrated in November, is announced by Moscow Radio.

October 8, 1957: Professor Yuri A. Pobendonostsev predicts over Moscow Radio that the next phase in the satellite program apparently will be the launching of a satellite with an animal aboard.

November 3, 1957: *Tass* reports the firing on November 3, 1957, of a second artificial satellite with a dog in it.

December 10, 1957: Leonid Sedov, head of the Commission for Interplanetary Communication, as-



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serts in *Pravda* that the Soviet Union has had no failures in launching her artificial satellites.

What does this teach us? First of all we must admit that although the Soviet Union regards her satellites as part of the military program for the development of long-range ballistic missiles, the whole project was astonishingly well covered in the news — so well covered, indeed, that the West failed to perceive what was ahead.

Things to Come

Since the launching of her artificial satellites, the Soviet Union has been holding herself out as the world's leader in technology. Having thus overcome her technical inferiority complex, the Soviet Union has been turning out an abundance of reports, mixing facts with fancy. They are certain to serve one day as proof for an eventual claim to a Soviet "first" when one or another prophecy comes true. Stripped of their fanciful trimming and boiled down to technically feasible fact, the reports state that:

¶ Within the next 18 to 24 months, a Soviet rocket will reach the moon.

¶ A locomotive driven by atomic energy will shortly be in service.

¶ The production of pig iron by a cold, chemical process will be announced during 1958.

¶ New methods of producing the more complex hydrocarbons are being developed (acetic acid from the oxidation of liquefied butane, for example).

¶ Important successes in controlling thermonuclear reactions will be achieved perhaps before the end of 1958, making this year a "turning point in the history of mankind."

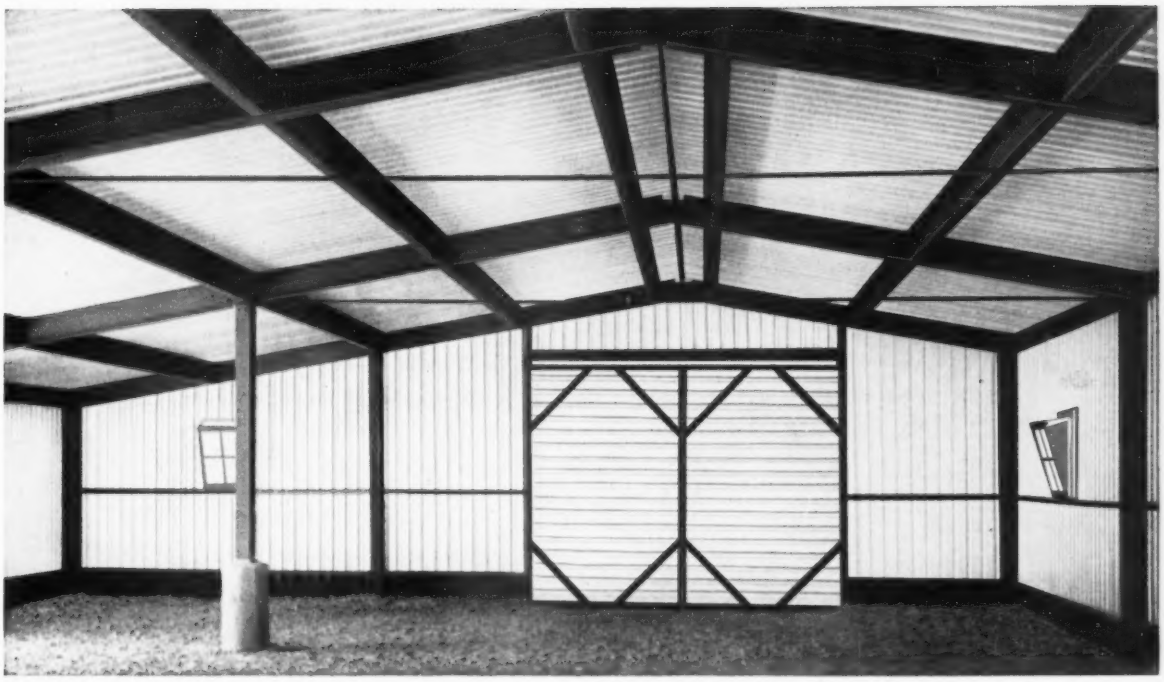
¶ Laboratory installations already have been constructed that can transform heat directly into electric energy. The efficiency is said to be more than 60 percent compared with 25 to 35 percent for conventional steam power plants.

¶ Transformers of solar energy into power will become economically applicable in the next few years.

¶ The internal heat of the earth will be used for power. Experimental drillings are being carried out on the volcanic Kamchatka peninsula, where a subterranean power station is to be constructed.

¶ Atomic batteries of radioactive strontium and promethium now permit the direct conversion of atomic energy into electric energy. These atomic batteries are being perfected so that they will generate current for equipment used in aircraft and rockets.

Based on past experience with news reports these are the developments to watch. How many of them will show up on schedule and in as perfected a state as suggested here, no one knows. The Soviets, as we have seen, do not announce until tests are successful. But they do tell freely, if not directly, what they are working on. There is no reason for the West to be surprised — if we just read between the lines of the Soviet press. ▲▲



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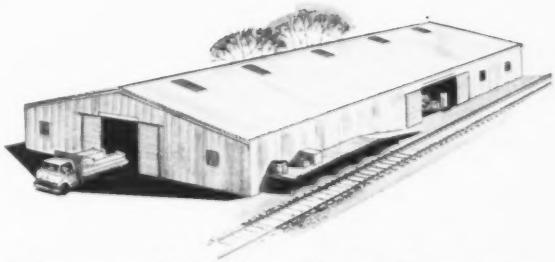
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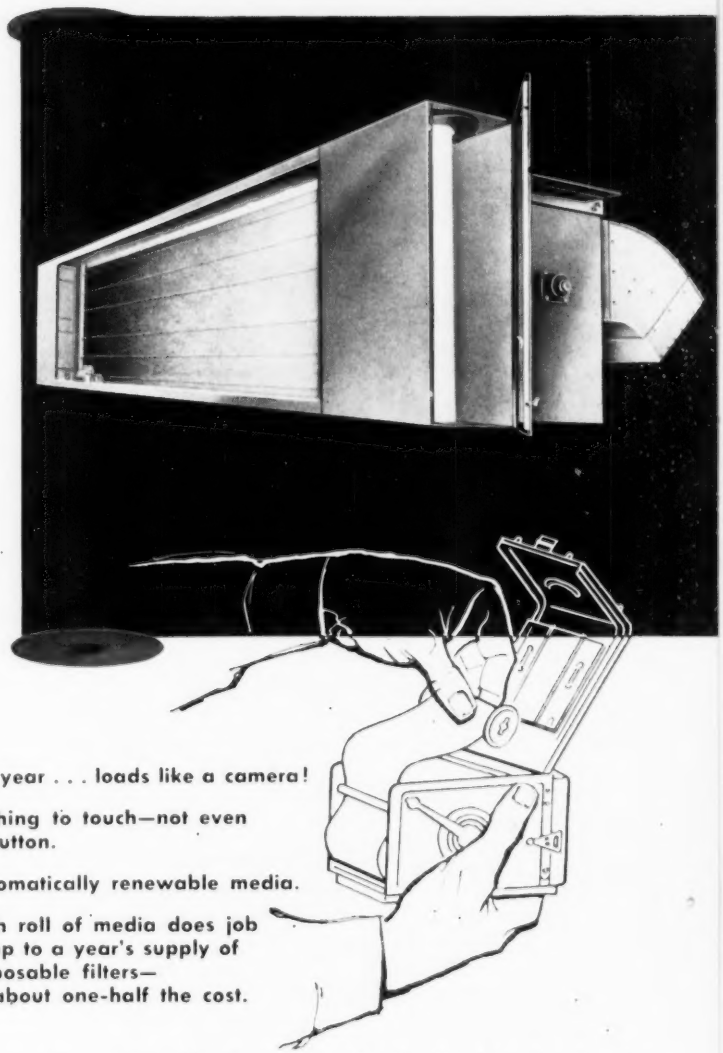
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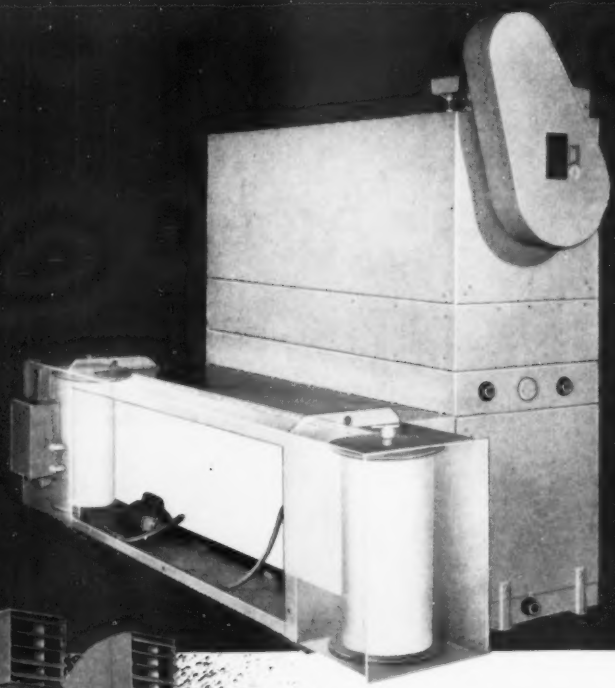
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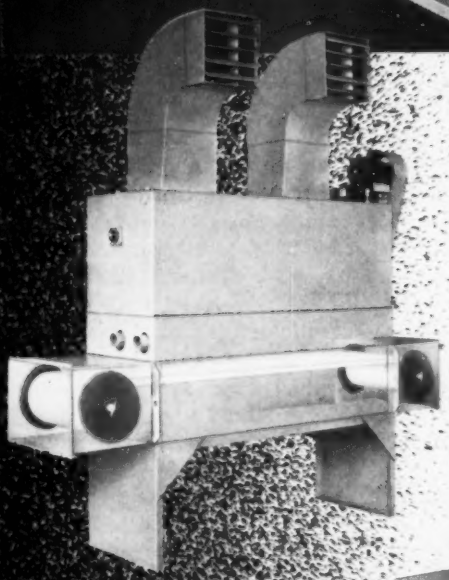


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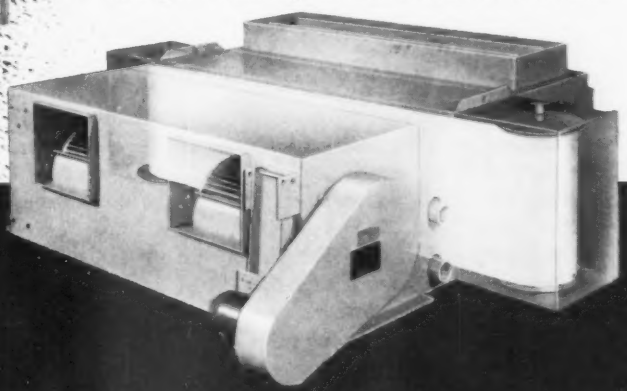




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The Challenge of Atoms in Action

WE ARE FORTUNATE to be alive in an era in which the discovery of atomic energy and the conquest of outer space offer opportunities and challenges without parallel in history. This era places a special responsibility on engineers and scientists to assume a role of leadership in developing this scientific bounty for the good of mankind. Engineers also must interpret the true significance of this bounty as a force for human happiness. The engineer is a member of a profession, which by definition is devoted to the welfare of mankind, so his responsibility is clear.

Scientist and Engineer

The pure scientist is motivated by a thirst for scientific truth. The application and even the interpretation of scientific truth for the human community is often of secondary interest to him. The engineer, on the other hand, is motivated by a desire to satisfy human needs. If the scientific facts required to satisfy a human need are not known, the engineer will assume the role of a scientist, and yet, he will not hesitate to resort to empiricism, intuition, and even rule-of-thumb to achieve the desired end. The engineer, like all members of a true profession, is of this world. He can never escape to an ivory tower. Where the engineer has failed is in clearly understanding his own basic motivation and in interpreting his motives for other men. Too often he is contented with the acceptance of an assignment from others. He neither understands nor questions. If the engineer has failed in demonstrating true professional responsibility in these times, he must examine the cause of his deficiencies and assume strong leadership in the professional education of future engineers.

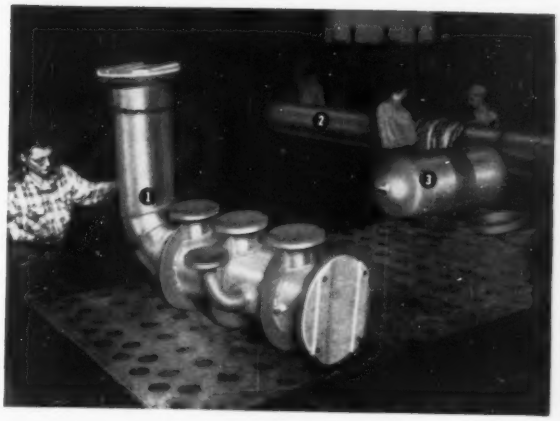
The first thing engineers must recognize is the impact of accelerated scientific discovery on the course of civilization. The discovery of fire, the discovery of the metallurgy of bronze and iron, and the invention of the steam engine had far reaching social and political effects. The invention of mechanical power, and the industrial revolution it sponsored, not only freed man from considerable toil but liberated him from feudalism and slavery. Great scientific and technical discoveries have been essential forces in liberating the spirit of man, and without these forces it is doubtful that democratic government would ever have been possible. It is significant, however, that the time scale and conceptual simplicity of these discoveries were such that men could understand and assimilate them.

Fear for the Future

In this era the time scale of discovery has been greatly compressed, and the conceptual complexity of the discoveries has surrounded them with an aura of mystery. Furthermore, the awesome introduction of these discoveries to the world has struck fear. It is a tragedy that the discovery of nuclear energy had to be announced to the world in the destruction of Hiroshima. It is a tragedy that man's initial conquest of space should strike fear because of its implications of destructive intercontinental missiles. Nevertheless, the discovery of fire and the fashioning of the first bronze and iron weapons must have struck similar fears in early man. The invention of the steam engine and the dynamo certainly raised questions about man's spiritual welfare – questions so well examined in the chapters dealing with the "Dynamo and the Virgin" in *The Education of Henry Adams*. It is heartening to remember that man not only perfected these discoveries for the welfare of all men, but he learned to control their potential for evil.

The terror of the new powers for destruction has obscured the great potential these discoveries hold

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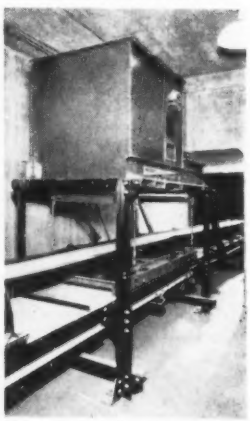


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for the good of man. It is ironic that engineers have failed to satisfy, or perhaps even recognize, the greatest human need of this era – the need to understand the full meaning of recent scientific discoveries. Engineers have lacked the perspicacity and articulateness to interpret their bounty as a force for good in terms dramatic enough to match the impact on the public mind of the destructive forces. This failure to interpret has resulted in a fear that the discoverers are ignorant of the consequences of the discoveries.

The Engineer's Responsibility

Engineers have a responsibility which extends beyond the interpretation of their bounty. They have a responsibility to exercise their creativity in recognizing imperative human needs that can be satisfied by the new discoveries. They must act promptly to satisfy these needs so that the demonstrated good derived from the atom and the conquest of outer space will render ineffective and purposeless the employment of these scientific advances for destruction.

Engineers also must be courageous and articulate in assuming a role of leadership in the world. In recognizing the need for an unrestricted exchange of ideas in free science and engineering, they should courageously identify the destructive effects of foolish attempts to hide scientific knowledge behind walls of secrecy. They should not stand by in silence when we shamelessly discard some of our most cherished freedoms in a fit of demagoguery which in many respects resembles the despised tactics employed so generally by totalitarian regimes.

Engineering Education

If there are deficiencies in the ability of engineers to meet their professional responsibilities, the education of the engineer deserves the severest scrutiny. If war is too important to be left to the generals, education is indeed too important to be left to the educators – or even worse, the politicians. All education, and particularly the education of engineers, should be a matter of real concern to the engineering profession. We hear of crash programs for the education of engineers as though the education of an engineer were analogous to the training of urgently needed military pilots. In view of the professional responsibilities of the engineer to humanity, it should be obvious that crash programs that reduce engineering education to mere technical training would be disastrous in a free nation. Hence, it is clear that education for any profession is not a unilateral undertaking of the professional schools but is a process requiring the utilization of all the intellectual resources of a college or university.

The engineering profession has a responsibility to be articulate in its advocacy of adequate support for all education. Otherwise the future of the profession may rest in the hands of men who are incapable of evaluating the human needs they strive to meet. As



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citizens, engineers must be quick to recognize and assert that without a respected and dynamic intellectual leadership on all facets of human activity, a democracy cannot exist even if the short-term gains of regimented crash programs in engineering in a totalitarian nation may appear to contradict this.

Too Many Engineering Students

Yet the engineering profession must admit that there are apparent deficiencies in the present education of engineers for professional responsibility. Of late entirely too many students have been attracted to the engineering schools by the certainty of a well paying job upon graduation. Fortunately for these students, many of them fail to graduate, but unfortunately for the colleges, they cause a waste of severely limited resources and contribute to the general breakdown of standards. The public clamor for more engineers is satisfied at the expense of better educated engineers. The public, the educators, and the engineering profession share the responsibility for this state of affairs, but the primary responsibility rests with practicing engineers, who must insist on a high level of education for the profession. In this responsibility the engineers have failed in comparison with the medical and legal professions.

To meet the needs of the engineering profession in this era, the education of the engineer must be drastically revised to reflect a better scientific and humanistic education prior to admittance to the professional school. To accomplish this objective, an immediate two-year – and an eventual four-year – curriculum in pre-engineering at the college level emphasizing basic science, mathematics, humanities, and the arts must be required as a condition for admission to professional schools of engineering. Admittance to the pre-engineering curriculum should be open only to those students who have demonstrated a superior accomplishment in the sciences, mathematics, and other college preparatory courses at the high school level. The professional engineering school should be elevated to the level of the professional schools in law and medicine.

Standards for Schools

Exacting standards should be imposed on the qualifications of the faculties and on the physical facilities of the professional schools of engineering. Professional schools failing to meet these standards should be publicly rejected by ECPD and the whole engineering profession. Their graduates should be denied admittance to practice. A firm policy of accreditation backed by the entire profession would do much to secure the financial support necessary to maintain first class professional education – an important consideration, particularly in view of current costs.

It is true that higher standards may result in the production of fewer engineers. However, it is obvious that a large number of poorly educated engineers is no substitute for well educated engineers no matter how small their number. The professional and even the material rewards accorded a profession that insists on high standards for membership provide the strongest motivation to candidates for admittance to its ranks.

Democracy's Answer

This must be democracy's answer to motivation by subsidization of specialized training and to the regimented scholarship of the totalitarian state. A comparison of American and Soviet medicine offers ample evidence that the accomplishments of free men motivated by membership in a profession demanding high standards cannot be matched by any form of artificial stimulation.

In this atomic and planetary era engineers must assume leadership in explaining new discoveries in understandable terms; in interpreting their meaning as forces for good as well as evil; in recognizing and satisfying human needs through these discoveries, thus reducing the utilization of the destructive potentials to absurdity; in speaking out to preserve our freedoms in the face of panic born of ignorant fear; and in demanding a standard of professional education consonant with the needs of this era.

Thus, the actions of man can meet the challenge of atoms in action. ▲▲

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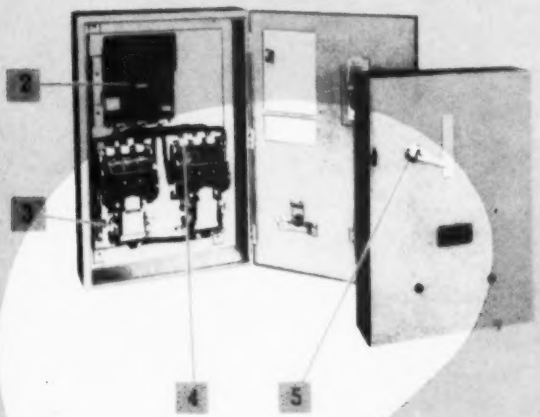
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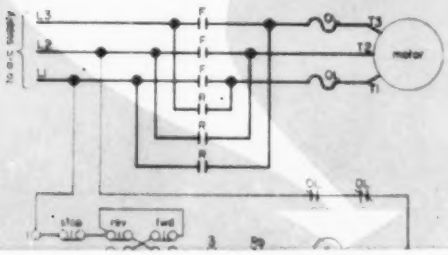
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	2	0	30E	S0DNNA	W1DNNA
	3	1	40E	S1FNNA	W1FNNA
	3	1	50E	S1GNNA	W1GNNA
	5	2	70E	S2HNNA	W2HNNA
	10	2	100E	S2JNNA	W2JNNA
	15	3	100F	S3JNNA	W3JNNA
	25	4	200J	S4NNNA	W4NNNA
220	1	0	15E	S0ANNB	W1ANNB
	3	0	20E	S0BNNB	W1BNNB
	3	1	30E	S1DNNB	W1DNNB
	7½	1	50E	S1GNNB	W1GNNB
	10	2	70E	S2HNNB	W2HNNB
	15	2	100E	S2JNNB	W2JNNB
	30	3	100F	S3JNNB	W3JNNB
	50	4	200J	S4NNNB	W4NNNB
440	5	0	15F	①S0ANNC	①W1ANNC
	5	1	30F	①S1DNNC	①W1DNNC
	10	1	40F	①S1FNNC	①W1FNNC
	25	2	50F	①S2GNNC	①W2GNNC
	50	3	100F	①S3JNNC	①W3JNNC
	100	4	200J	①S4NNNC	①W4NNNC
550	5	0	15F	①S0ANND	①W1ANND
	5	1	20F	①S1BNND	①W1BNND
	10	1	30F	①S1DNND	①W1DNND
	10	2	40F	①S2FNND	①W2FNND
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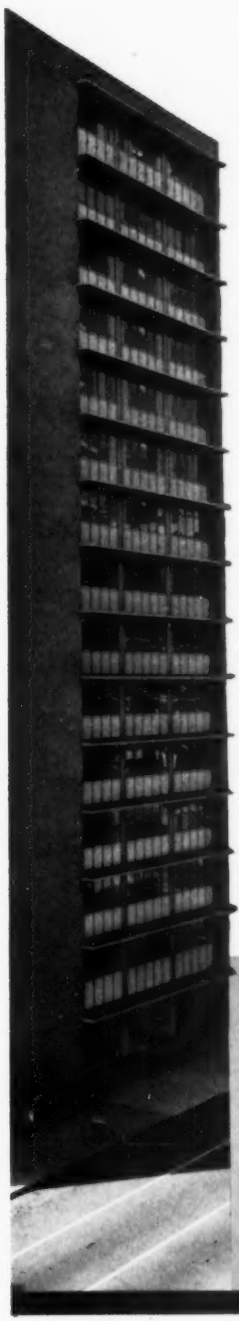
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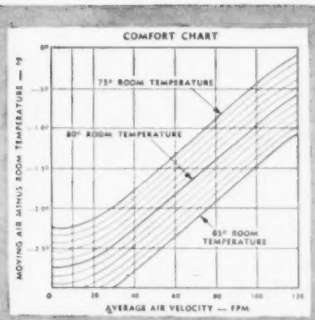


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Report From The East Coast

STAFF

THE American Society of Civil Engineers professional practice task committee on the revision of Manual 29* hopes to have suggested fee curves for consulting engineers on highway projects completed in less than one year.

"My guess is that it will take no longer than six months to complete the schedule," said Louis R. Howson, ASCE president and chairman of the committee.

For some time Howson's committee had been working on a modification and upward revision of Manual 29. Then, in November, Bertram Tallamy, Federal Highway Commissioner, suggested that a fee schedule for highway projects should be set up. As a result of this suggestion, the task committee was instructed by the ASCE Board of Direction to make a special study to develop fee curves covering highway engineering consulting services. A separate chapter of the manual now is being prepared.

"After the fee curves are completed, we hope it will be used for guidance by all public agencies employing consulting engineers," Howson added.

CEC Viewpoint

Having dealt with Tallamy on the matter of fees, the Consulting Engineers Council feels that since this is a matter involving only consulting engineers, they should take part in any discussions. However, Howson said that — at this time — "We do not feel we can broaden the committee." But, he said, the committee will be glad to consider any data submitted by persons specializing in the highway field. Because much of the ASCE task committee's work is being conducted by mail, Howson suggested that any data be submitted in triplicate.

"We're trying to do something constructive. Although the committee has made considerable progress, nothing definite has been completed at this time," Howson explained.

Throughout the fee discussions, Howson's committee has worked closely with representatives of the Bureau of Public Roads. Howson said a joint ASCE and American Association of State Highway Officials standing committee also has been requested to submit any information or suggestions that might be of assistance to the task committee.

This standing ASCE-AASHO joint committee, in discussing proposed fees, decided that the work of consulting engineers falls into two classifications:
¶ Consultants selected because of superior experience and judgment on special engineering projects.
¶ Consultants selected for "production engineering," to augment the work force of the state highway departments. In this classification, the engineer is not expected to rely on his own experience or judgment, but merely to do routine location and design work under the control of the state highway departments.

The second classification was cited as the most prevalent reason for highway departments hiring of consulting engineers.

At a meeting of this joint committee, the possibility of selecting "production engineers" on a basis of competitive bids was discussed. "And the question of competitive bidding did not come up entirely from our side of the table," an AASHO spokesman pointed out, the implication being that the ASCE representatives did not oppose the idea of competitive bidding for "production engineers." "It has been my experience," he continued, "that consulting engineers will bid on a project when the opportunity presents itself."

However, the committee decided that instead of separating the two types of work by selection on a professional basis and by competitive bidding, two fee schedules are needed.

The American Road Builders Association engineering division also is preparing data on highway

*Manual 29 is ASCE's *Manual of Professional Practice for Civil Engineers*, which includes recommended charges for civil engineering work. It was published by ASCE in 1952.

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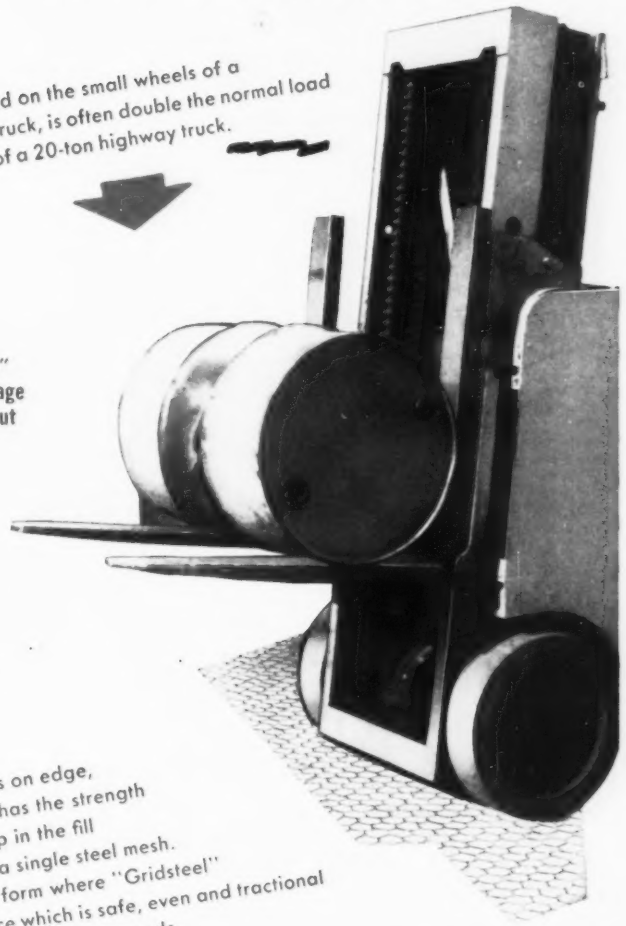
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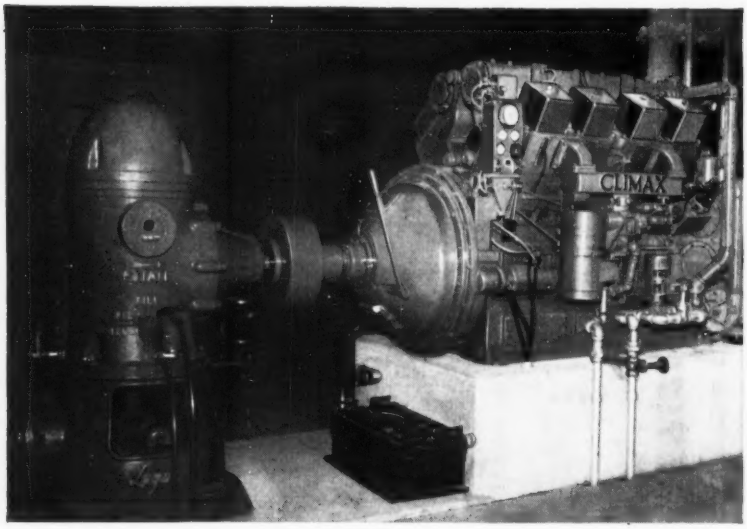
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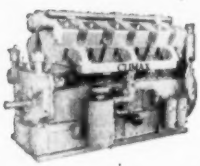
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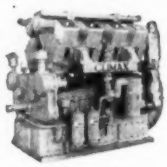
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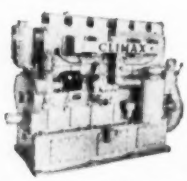
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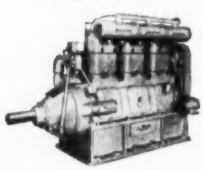
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engineering fees and prequalifications of engineers. The division is composed of representatives of 80 consulting engineering firms. Division president is O. J. Porter, president of Porter, Urquhart, McCreary & O'Brien.

Porter, in discussing ARBA cooperation with the joint committee on this project, explained that "it is the desire of consulting engineers to work more closely with state highway officials."

Porter said his committee is preparing data on the scope of services of consulting engineers in order that they may properly perform work on highway and airport projects.

Fee Schedule Coverage

The ARBA group will define and coordinate the following four stages of engineering:

¶ Preliminary reconnaissance and route selection. Also includes traffic surveys.

¶ Preparation of a detailed report and cost estimates.

¶ Preparation of a detailed design and plans for submission by client to contractors for bidding purposes. May include detailed survey. Also use of electronic computers and plotting equipment would fall in this category.

¶ Engineering supervision of the necessary construction work.

Porter said the ARBA group will study the range of fee schedules to be applied for each of these different classifications of consulting engineering services.

"No set pattern fits any state. Organization of the highway departments, laws, and other situations differ. When the states receive the completed fee schedules and criteria for selecting engineers, they will use the information as they see fit," Porter said.

Elsewhere on the Highway Scene

In addition to Tallamy's request for a fee schedule and the usual needs for standardized fees, another incentive for an immediate fee scale has been presented as the result of an investigation by

Keeping Plant Cleanliness on a HIGH KEY

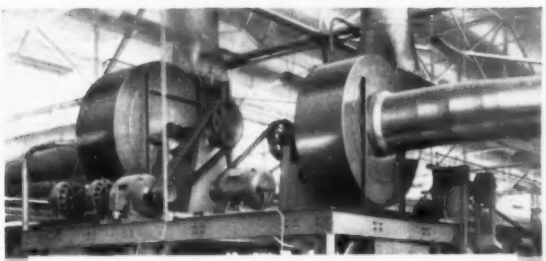
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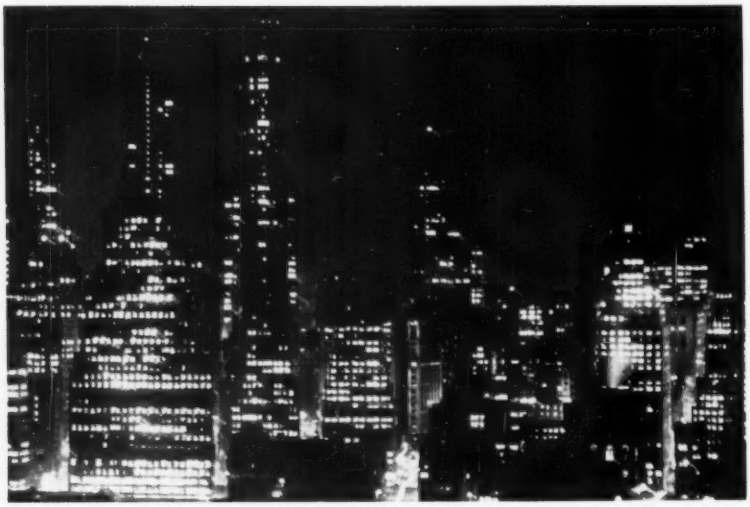
*Two large EX Fans serving main shavings exhaust system. CFM totals 48,000.



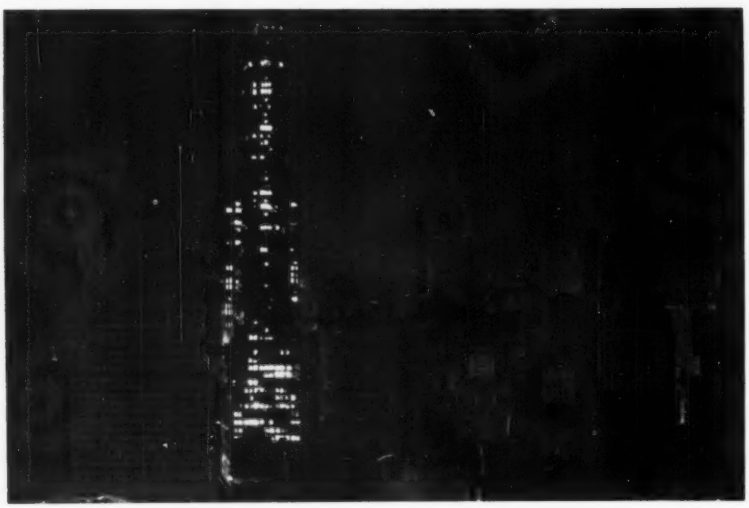
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the projects examination division of the Bureau of Public Roads.

Although the results of this investigation (dealing with selection of and fees paid consulting engineers) have not been announced, the findings have been referred to by one official as "a close second to right-of-way as a potential source of undesirable publicity, if not some scandal."

The Automotive Safety Foundation also is looking into highway organization and conditions in Pennsylvania. This is the first time this group has attempted a study of this type.

A Bit of Bad News

A. E. Johnson, executive secretary of the American Association of State Highway Officials, said a great many states are planning to add to their own state highway department staffs instead of using consultants on the multimillion dollar Federal road program.

Johnson pointed out that at present, eight states do not use consulting engineers; six states retain consultants to a major degree; and 35 states use consultants only to augment their regular department forces.

"The highway program is not a peak load project, and it will extend over a long enough period to allow the departments to expand economically," Johnson explained. "Although they will try to do so as little as possible, some states still will use some consulting engineers."

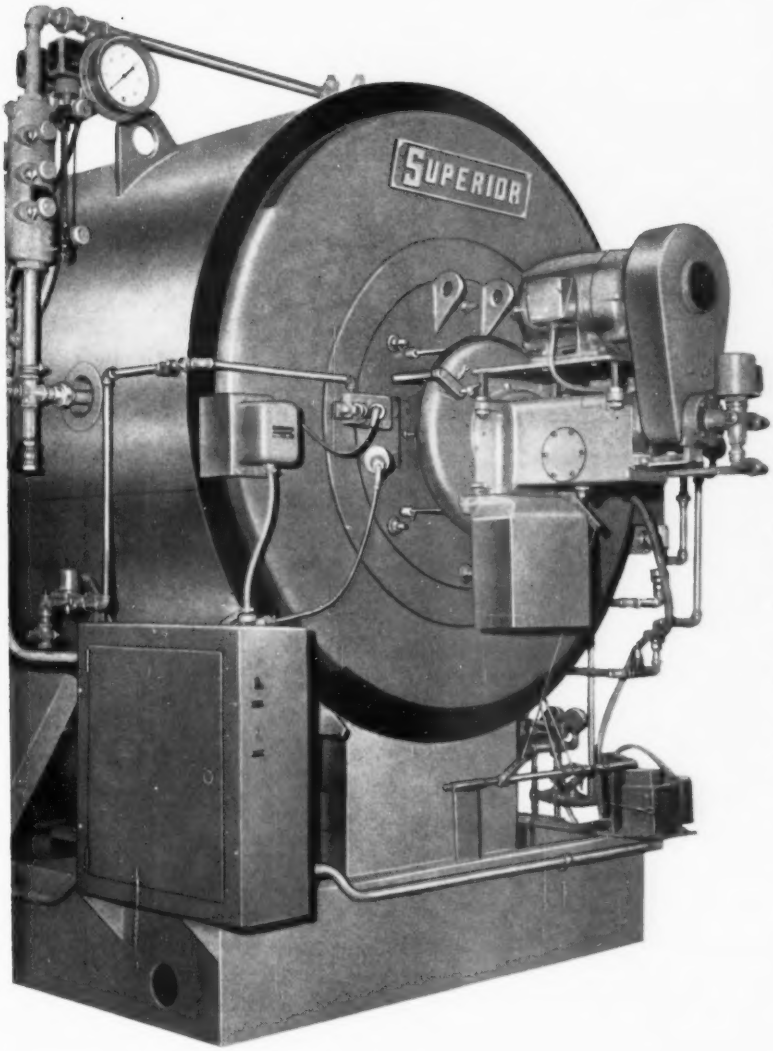
Johnson was asked why fee schedules and criteria for selection of consultants are important to the American Association of State Highway Officials. He explained that highway departments in many areas are not too familiar with what fees should be. When selecting a consulting engineer on a professional basis, they sometimes have trouble justifying their selection to budget-conscious municipal and state officials.

Johnson thinks the fee schedules and criteria will "put the highway officials in a protected

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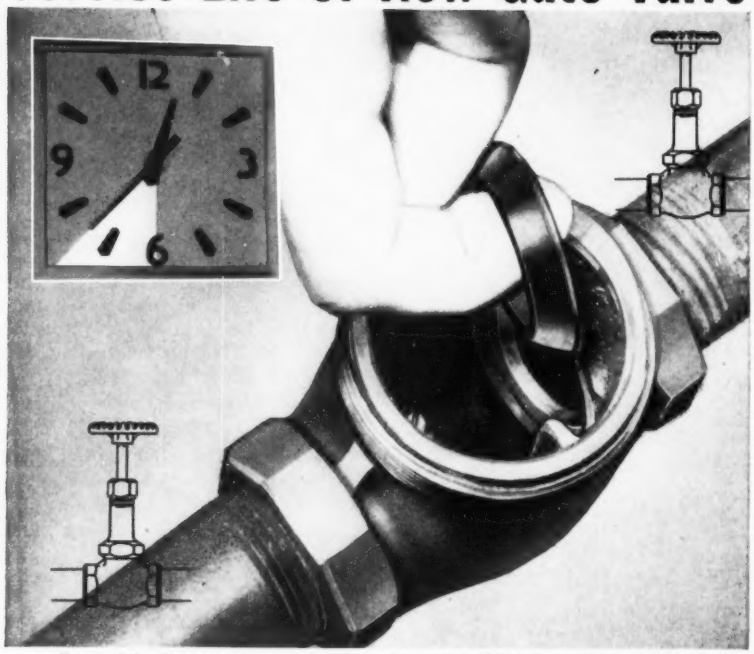
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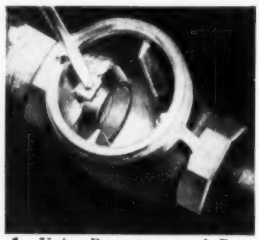
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spot. He can show a schedule of consulting engineers who are particularly suited for a project. Then, with a fee schedule, there would be no future need for competitive bidding."

At the ARBA Convention

More than 2000 persons gathered in Washington to hear the news on the Federal highway project and other highway topics of interest.

Senator Francis Case (R-SD) told the ARBA members that the Interstate Defense System, as it is unfolding, will give the highway user shorter routes and cover more miles than promised. The original Interstate System was authorized for 40,000 miles. As the state highway authorities worked out routes, straightened alignments, cut out square corners, or followed straight lines instead of jagging north a mile and south a mile, the actual miles needed to cover the distance between two points was reduced. A surprising total of 1452 miles was saved by this cutting of corners.

The Interstate Defense System, as it develops, will provide the highway builder with more work and more jobs than he has expected. The design which permitted shortening of routes also calls for more structures and cloverleafs than the old routes that followed the line of least work. He quoted a Bureau of Public Roads report — "To serve local needs . . . will require an estimated 63 percent more highway grade separations, interchanges, other structures, and additional frontage roads than had been considered in determining the amounts authorized by the 1956 Act."

Another report to the convention showed that 27 state highway departments now have electronic computers and practical application for them in many phases of highway work; 12 more are in the process of developing and installing electronic computer services; and some 40 or more consulting



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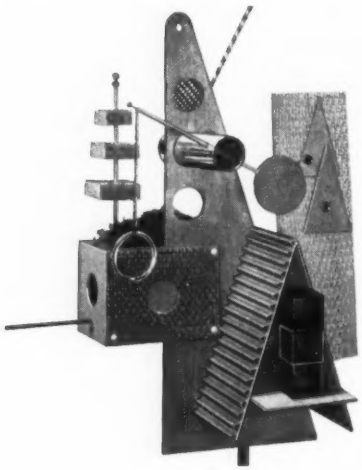
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Financial Problems

C. R. McMillan, chief highway commissioner of South Carolina, discussed "The Financial Problems of the States in Matching Federal Aid Funds."

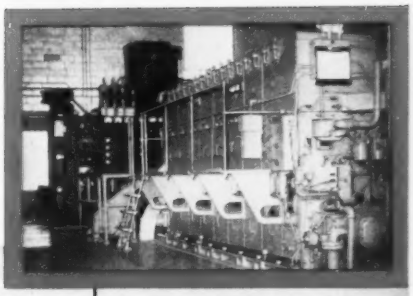
McMillan said, "the present requirements that bidders must perform at least 50 percent of the work with their own forces is a good one which should be respected by all contractors. The industry must constantly police itself for strict adherence to regulations, for brokering of jobs leads to increased costs and can endanger our ability to carry out the new road program. Even though illegal, there apparently are means of getting by, but any widespread appearance of the practice probably will lead to severe restrictions which could handicap the Departments and road builders alike.

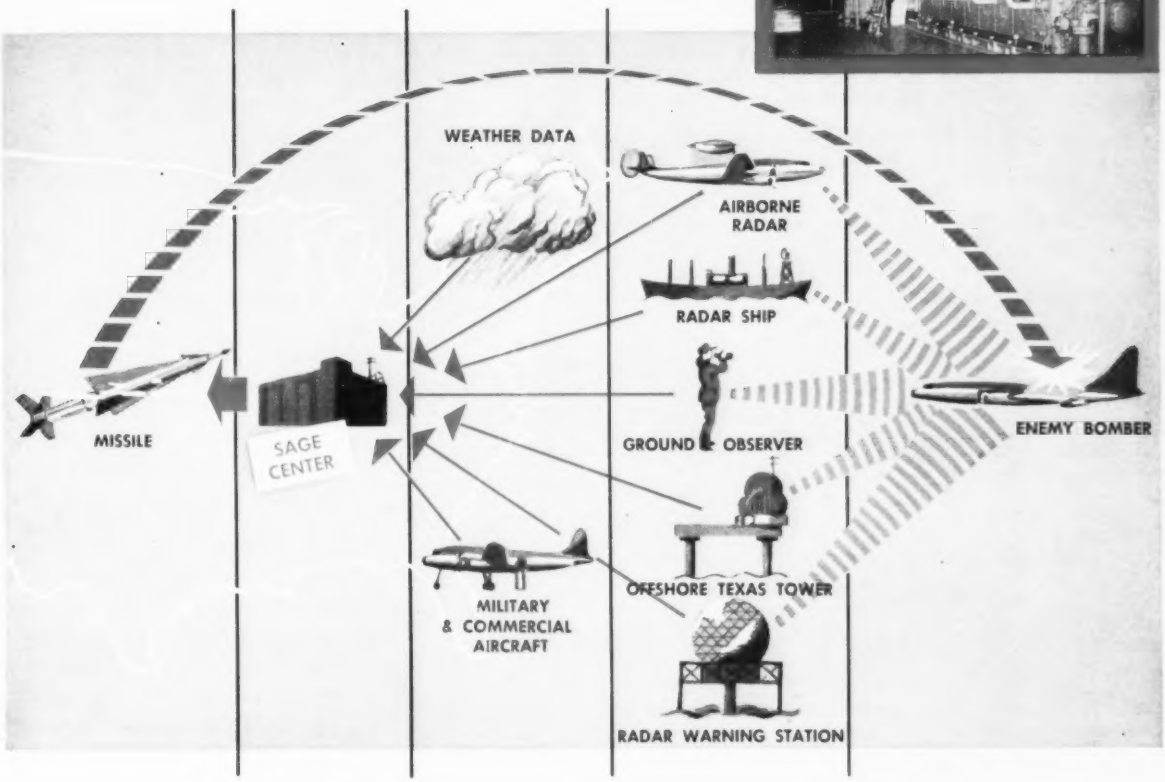
"Another matter which is more or less of financial consideration to the states is unqualified contractors bidding on jobs. This is a delicate matter for highway officials to discuss, for we will not do anything to discourage or reduce competitive bidding for contracts. We like competition. We demand it, as a matter of fact, but we want it to be on a sound basis. Construction costs can be reduced by highly qualified contractors, but they can be increased by the man who is not able to carry out his promises."

Tallamy told ARBA members that the government cannot make financial obligations that will exceed highway trust fund receipts,

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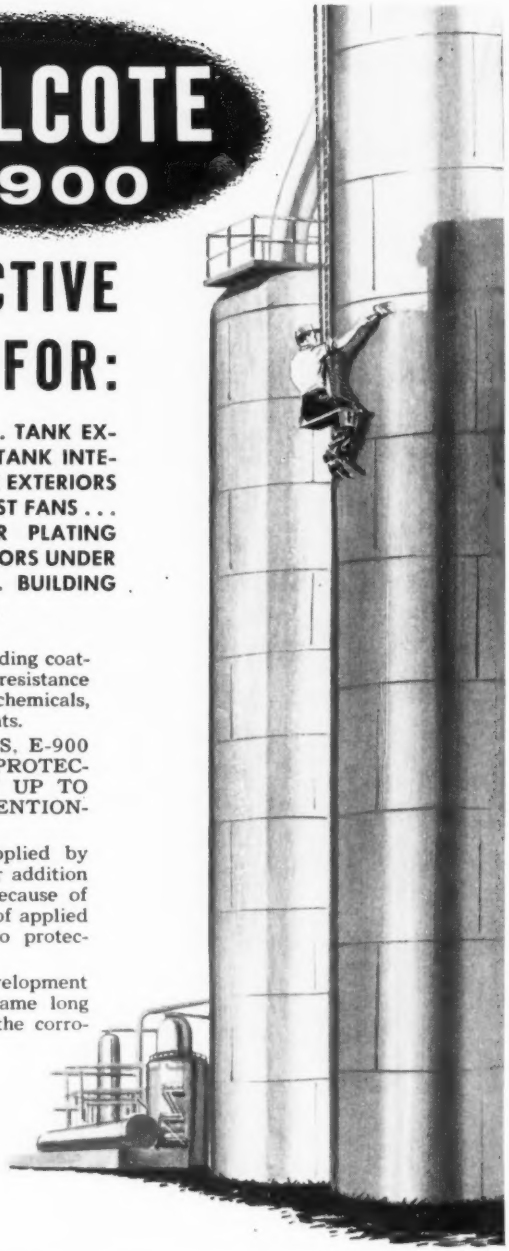
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and due to the upward revision of program cost estimates, the program could extend at least 7 years longer than the generally accepted period of 13 years.

The Federal Highway Administrator also referred to the shortage of highway engineers as a thing of the past. "The supply of engineers is well under control."

During the ARBA convention, a consulting engineer, Farley Gannett, chairman of the board of Gannett, Fleming, Corddry and Carpenter, Inc., of Harrisburg, Pa., died following a heart attack. Mr. Gannett for many years had been an ARBA member. He also was on the engineering division board of directors.

Employment Trends

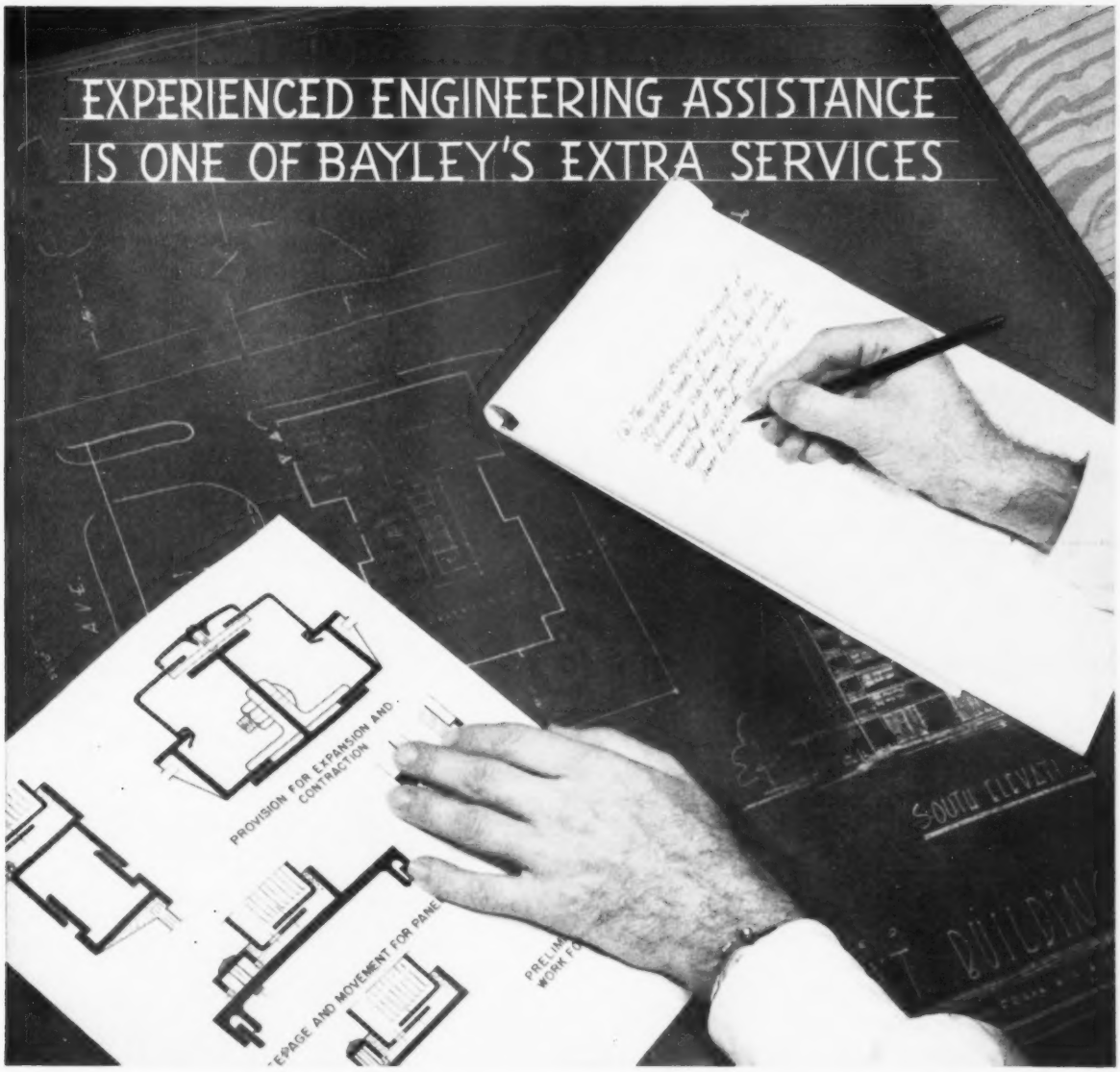
Since the first of the year, the employment picture for engineers has changed rapidly. According to a nationwide employment group, which deals only with engineers, there now is no such thing as a shortage of engineers.

Large consulting engineering firms in New York, instead of vying for scarce young graduates, now are laying off men. The layoffs, since January, have been mostly among the engineering-construction firms. Independent consulting engineers are still busy — many even ahead of last year.

The employment agency, with offices throughout the nation, said the New York employment picture is not an isolated case. Detroit has the largest number of engineers without jobs since 1940 (and also the largest total number of unemployed).

Last year, the New York employment office averaged five engineers a day applying for jobs. Since January 1, the average has risen to 40 a day, with only about one of these being placed.

The agency official said the picture is "very peculiar." The engineering-construction firms are letting a large number of their engineers in the $12,000 to $15,000 salary bracket go in an effort to reduce expenses. ▲▲



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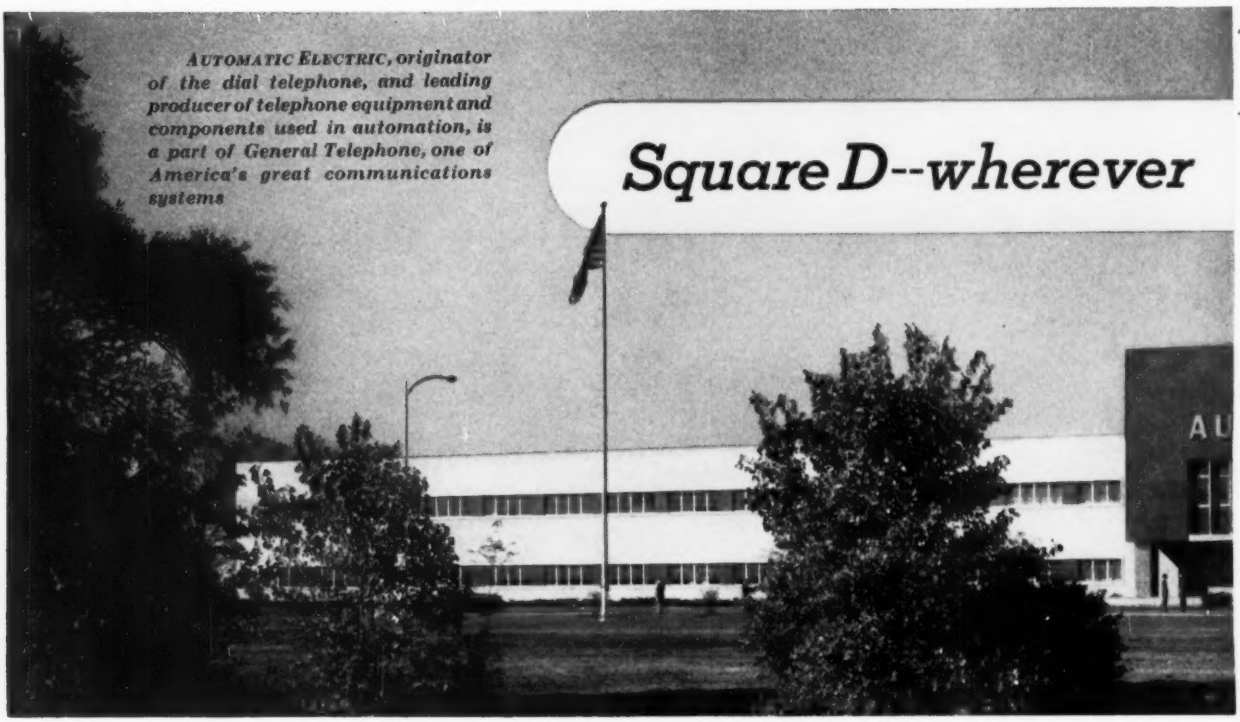
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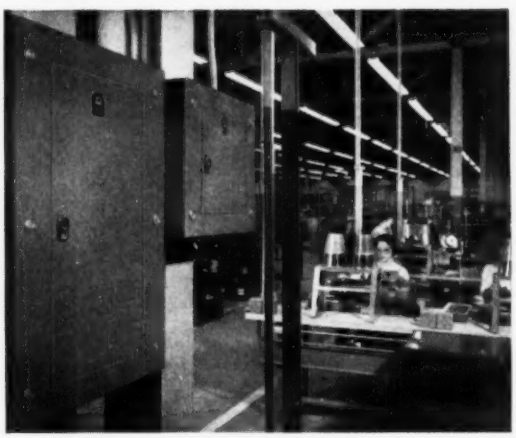


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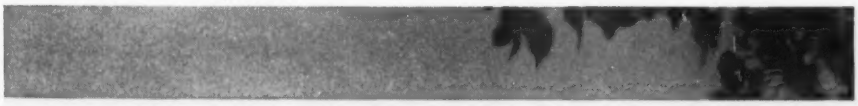
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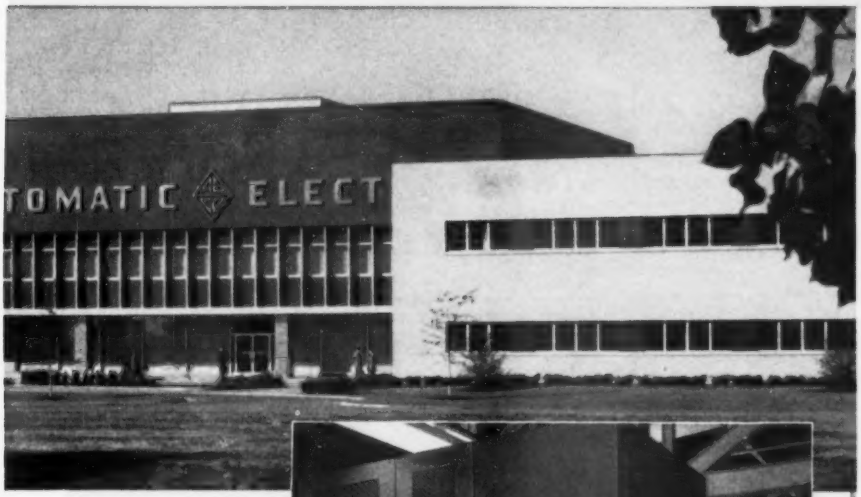
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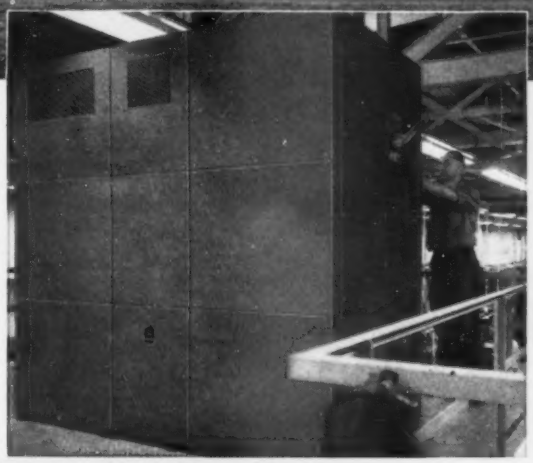
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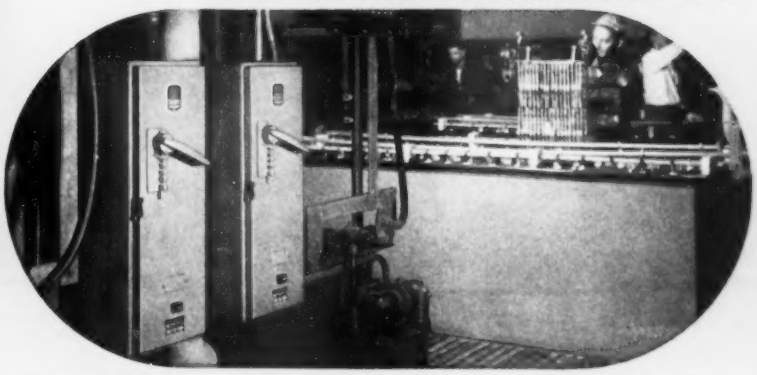
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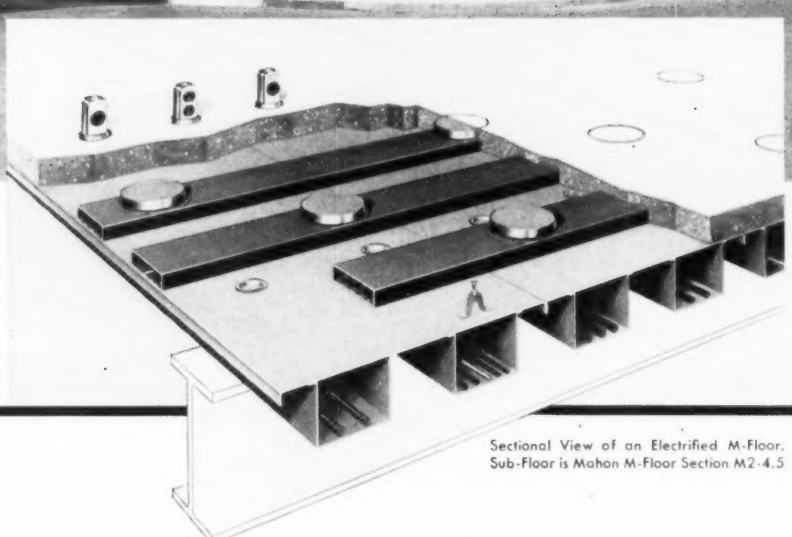
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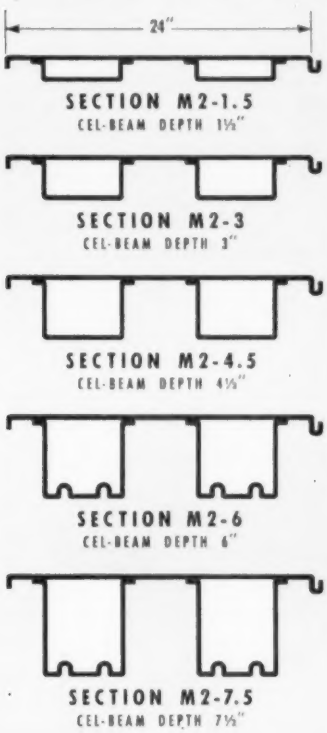
Sectional View of an Electrified M-Floor. Sub-Floor is Mahon M-Floor Section M2-4.5

Serving the Construction Industry Through Fabrication of Structural Steel, Steel Plate Components, and Building Products

Electrical Raceways Under Every Sq. Ft. of Floor Surface—Provide Greater Raceway Capacity!

Deep M-Floor Sections on Longer Spans Save Structural Steel . . . Reduce the Over-all Weight of a Building

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☆ *For INFORMATION See SWEET'S FILES or Write for Catalogues*

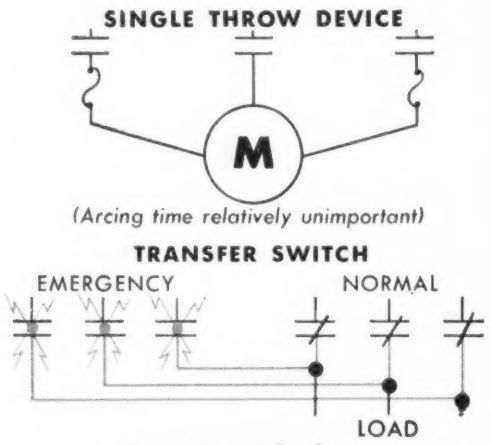
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NUMBER 4 OF A SERIES

...why instantaneous arc interruption is vital in Automatic Transfer Switch operation



Unextinguished arc shorts two power systems

Normally in single throw devices such as motor starters, arc interruption time is not a basic design consideration, except incidentally as reflected by tolerable contact erosion for a specified number of operations.

BUT . . . If two such devices are combined to form a Transfer Switch, time becomes a vital factor. Upon reduction or loss of normal voltage, your Switch must transfer connected load to an emergency source of the proper voltage and frequency. To provide continuity of light and power, this transfer must take place almost instantaneously.

Arc interruption must be correspondingly rapid; the arc must be extinguished on one Switch before contacts close on the other in order to prevent a short circuit from system to system.

Ordinarily, on transfer to emergency, the current interrupted is relatively small. However, upon retransfer to normal, the Switch must always interrupt maximum current and voltage. Furthermore, failure of the detecting relay coil supervising the normal source will mean maximum current and voltage must be interrupted on normal source contacts as well.

Even on two A-C three phase systems, out of phase conditions occur so that paralleling the systems without causing excessive current flow is impossible.

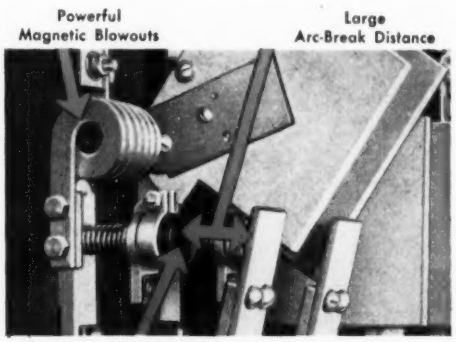
Here's why ASCO Automatic Transfer Switches give instantaneous arc interruption

ASCO TRANSFER TIME IN CYCLES
(60 cycle basis)

Amp. Reading	Normal to Emergency	Emergency to Normal
30	3	2
75	4	3
150	4	3
200	8	5
300	8	5
400	8	5
600	9	6
800	10	7
1000	10	7

In operation the separate arcing contacts guide the arc into an insulated chamber. Here a powerful transverse magnetic field, causing immediate arc disruption, is provided by current type magnetic blowout coils. With these coils, the strength of the magnetic field increases with the current, thus providing increasing arc disrupting ability.

Wide arc break distances further insure prompt disruption of the arc.



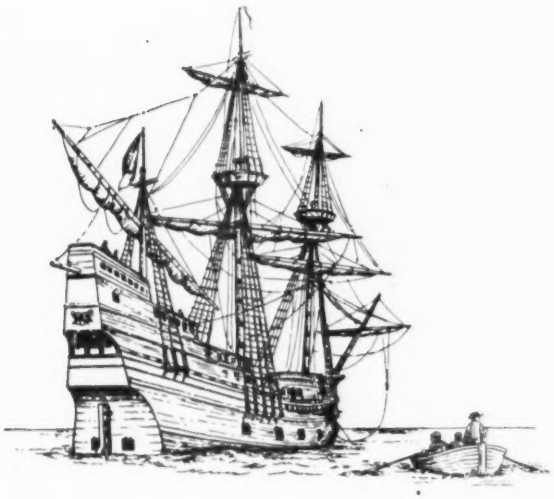
Floating Arcing Contacts

"ASCO Engineered" Automatic Transfer Switch with Circuit Breaker Construction One Arc Chute Removed.

Write for Catalog 57-S1, and for the Publication 596 describing how to select Automatic Transfer Switches.

Automatic Switch Co.
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Beyond Our Borders

World Bank Finances Construction . . . in Japan

Construction of the new hot and cold strip steel mills at the Chiba plant, near Tokyo, of the Kawaski Steel Corp., is well under way. These additions to the privately owned Kawaski Steel Corp., one of Japan's leading steel manufacturers, were a result of a $20-million loan by the World Bank in December 1956.

Early this year the World Bank made an additional loan of $8 million to assist a further stage of the Corporation's development to increase its pig iron production. Blast furnace facilities at the Chiba plant are to be expanded to raise pig iron production from 324,000 to 684,000 tons a year.

. . . And in Mexico

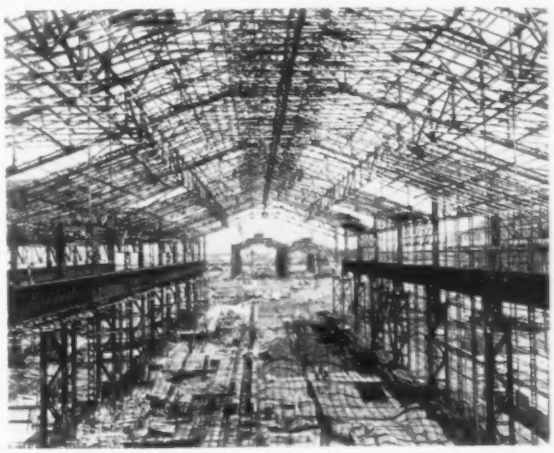
A loan equivalent to $11 million to the privately owned Mexican Light and Power Company Limited (Mexlight) for the expansion of the Company's electric power system has been made by the World Bank. Mexlight is extending its transmission and distribution systems and increasing its generating capacity to about 95,000 kw, or about one-fifth.

Seven private financial institutions are participating in the loan, without the World Bank's guarantee, for a total amount of $1 million of the first six maturities which fall due between September 1959 and March 1962. The participants are Credit Suisse, Sofina of Belgium, Canadian Bank of Commerce, First National City Bank of New York, Chemical Corn Exchange Bank, National Bank of Washington, and United States Trust Company of New York.

Mexlight distributes power in Mexico City and the surrounding area, not only from its own plants but also from the plants of the Miguel Aleman system of the Federal Electricity Commission. The area served by Mexlight is the chief governmental, industrial, and commercial center of Mexico. It covers about 12,000 square miles and, besides Mexico City and the other important cities of Toluca, Cuernavaca, and Pachuca, it includes about 400 towns and villages.

Mexlight has over 635,000 customers. They include, in addition to residential consumers, factories, mines, commercial enterprises, and public services. During the years 1955-57, the amount of energy sold by Mexlight increased by an average of some 12 percent annually. In 1956, 53.5 percent of the kilowatt-hour sales were to industrial consumers and mines, 18 percent to commercial and small industrial consumers, and 15 percent to domestic consumers. The balance represents sales to public services and tramways. Major industries in the area include textiles, metallurgy, cement, paper, rubber goods, engineering products, electrical appliances, and oil pumping installations.

The total cost of the expansion now being undertaken by Mexlight is estimated at the equivalent



VIEW OF NEW STRIP MILLS FOR THE CHIBA PLANT OF THE KAWASKI STEEL CORP., NEAR TOKYO, JAPAN.

of $28 million. The Bank's loan will cover the costs of imported equipment. Mexlight is meeting the local currency requirements through a loan equivalent to $8 million from Nacional Financiera, a government agency, and from its own resources.

The World Bank has now lent a net total of $152.3 million in Mexico, of which $90.8 million has been for the development of electric power, $61 million for railway improvements, and the remainder for industry.

Report on Prestressed Runways

M. A. Mayer, president of the French cement makers' research organization, reporting to the Prestressed Concrete Development Group, at the Royal Empire Society, in London, described success of the two prestressed concrete runways at Maison Blanche airfield in Algiers. The runways were completed in 1955 at an economical cost compared to normal construction, even though the subbase was not reduced in thickness. The slab is about 7-in. thick, half the thickness of the corresponding slab without prestressing. It is stressed transversely by 12-wire Freyssinet cable and longitudinally by flat jacks, with abutments built to take the thrust at each end of the runway. In this construction method the runway has no joints.

Built for a working load of 45 tons on a 2-ft 6-in. diameter circle, it has been tested up to 100 tons without cracking.

Australian Power Expansion

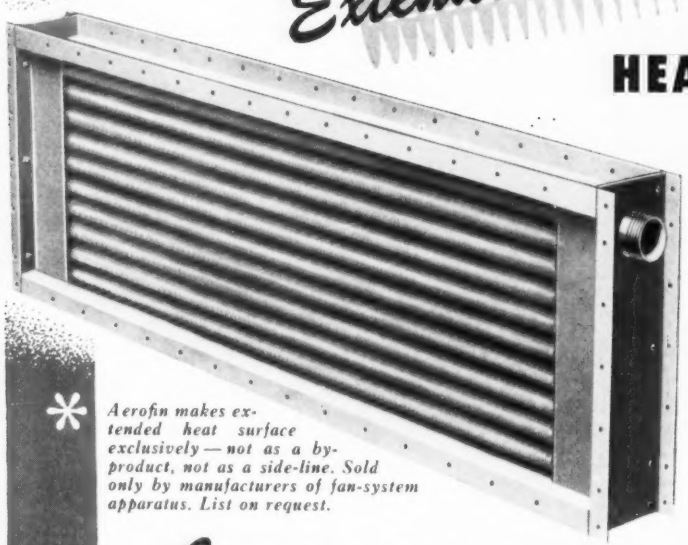
A new series of projects, now well beyond the planning stage, will increase substantially Australia's power generating capacity. Adding nearly two-thirds to its present power capacity, the Yallourn Power Station, in Victoria, is being expanded by the installation of two, 120,000-kw steam turbogenerators, the first scheduled to be in operation by mid-1961 and the second a year later. The State Electricity Commission of Victoria will install a boiler with a water evaporation capacity of 950,000 lbs per hr with each generator. Brown coal, plentiful in Australia, will be used for firing the boilers.

Meanwhile, the New South Wales Government has announced plans to build a new power station capable of generating 800,000 kw in the Lake Macquarie area of the coalfields in the northern part of the State. The $126-million project will take from 10 to 12 years to complete although the first unit is expected to be in operation by 1963. A second power station of similar capacity is contemplated for the northern coalfield region. The New South Wales Electricity Commission, which will operate the power stations, expects to establish coal mines near their sites to provide the 2.5-million

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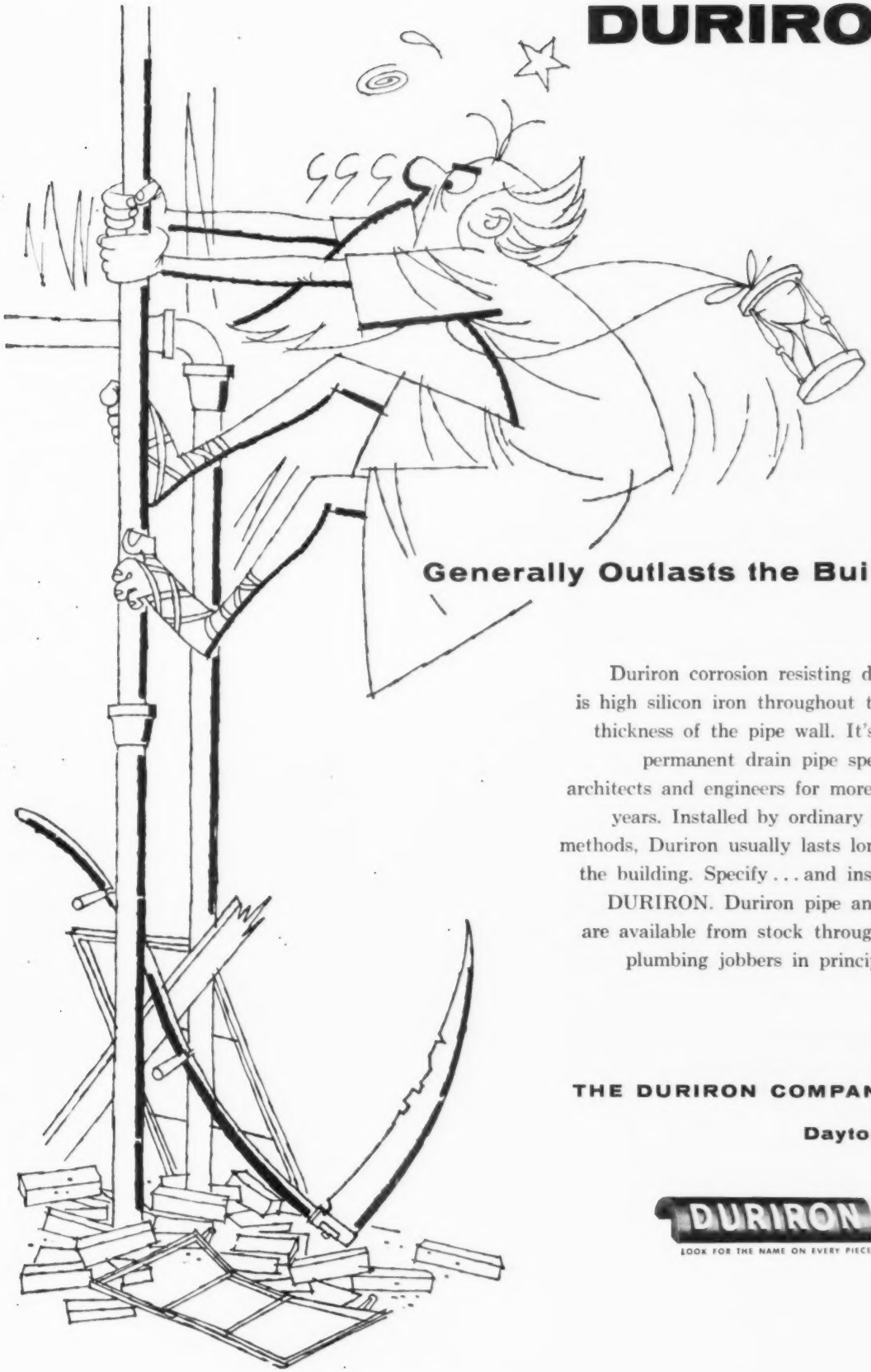
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tons of coal a year that the stations will require when operating at full capacity.

Mineral Finds in Pakistan

Recent surveys made by geologists in the Quetta and Kalat regions of west Pakistan have revealed deposits of chromite, high-quality iron ore, copper and manganese ore, as well as indications of gold in the Chagai district, on Afghanistan's border.

The geologists are carrying out an extensive survey for the Pakistani Government to find mineral resources for the country's growing industries. They have been assisted in their work by scientists from the Geophysical Institute, in Quetta, established by the Government, with assistance from UNESCO experts under the United Nations program of technical assistance.

Other minerals discovered include vermiculite, used as an insulator; flurite, necessary for iron and steel industries; barytes, a heavy mineral used in drilling; and asbestos. These discoveries have yet to be prospected to determine their commercial value.

During their operations the Pakistani geologists have used aerial photographs taken by the Photographic Survey Corporation of Canada, under the Colombo Plan. The photos make it possible to distinguish various rock formations and define possible mineralized zones. Maps, now being prepared in Canada from the photographs, will provide a basis for planning future surveys.

Underground Railway

Y. Higashi, director-general of the Teito Rapid Transport Authority, Tokyo, Japan, has submitted a project report for an underground railway for the Bombay Electric Supply and Transport Undertaking, a municipal authority.

The scheme envisages the construction of two underground routes, covering a little over nine miles. The routes are expected to be in full operation in six years, and would carry initially 400,000 passengers a year.

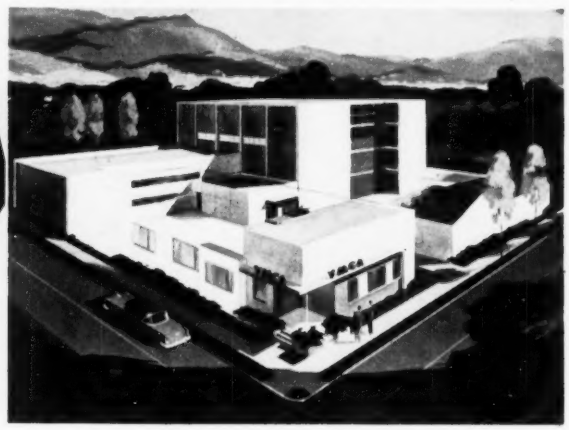
Seacoast Steel Plant

Construction is about to begin at Dunkirk on France's first seacoast steel plant, scheduled to produce at least 500,000 tons of steel. This is one of the major projects in the French steel industry's current modernization program which is expected to increase French production to 17-million tons by 1961.

Since the war France has invested over $1.3 billion in new steel plant and equipment. Total steel production has been raised from 4,408,105 metric tons in 1946 to a record 13,400,000 metric tons in 1956.

The planned complex is a type so far unknown to France — where steel mills previously have

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This modern structure for the Burbank Y.M.C.A.* includes Thermal forced air heating and ventilating units.

Thermal is proved equipment, specified with confidence that it will produce the utmost in performance and dependability. Write for detailed specifications.

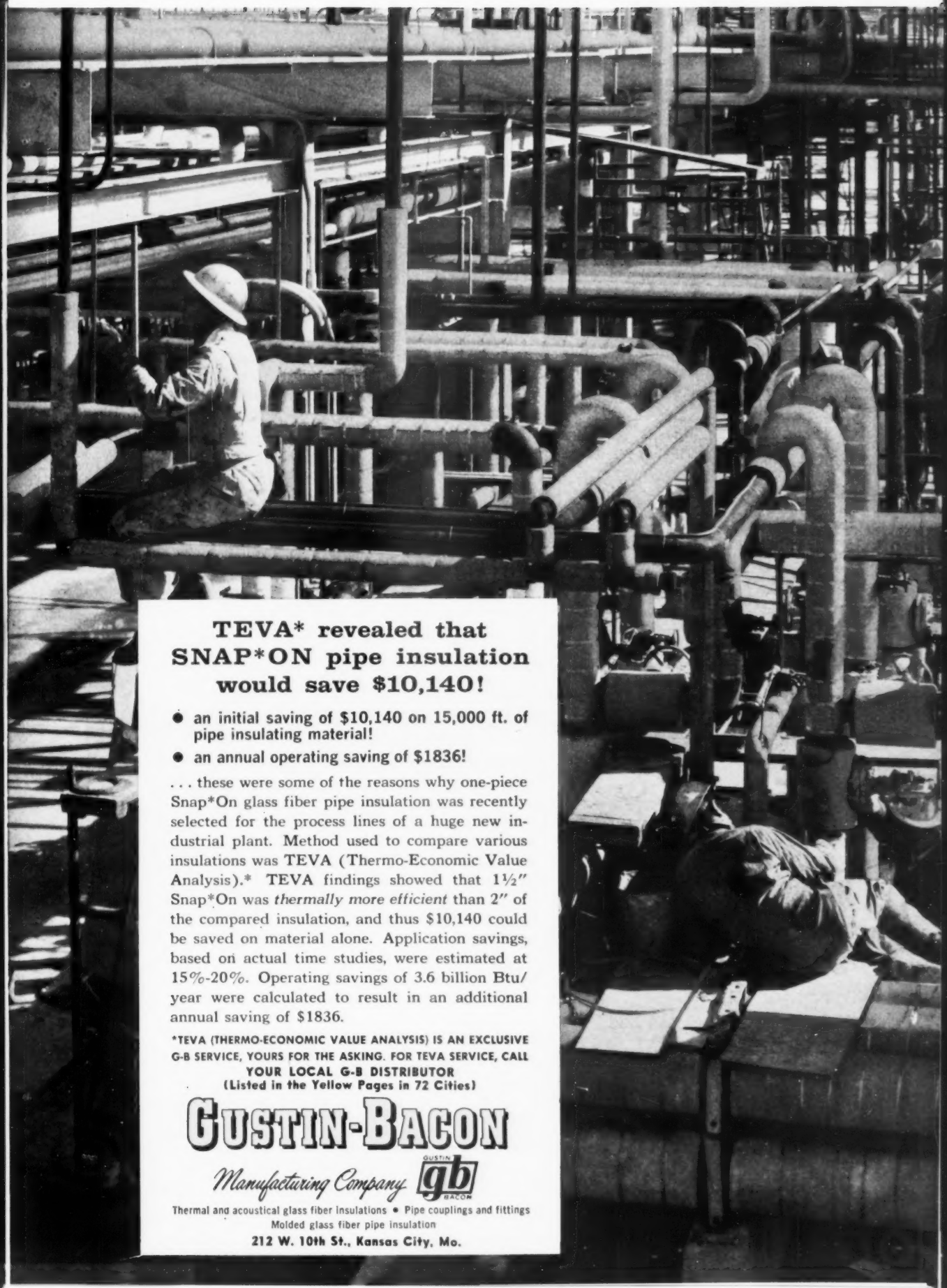
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TEVA* revealed that SNAP*ON pipe insulation would save $10,140!

- an initial saving of $10,140 on 15,000 ft. of pipe insulating material!
- an annual operating saving of $1836!

. . . these were some of the reasons why one-piece Snap*On glass fiber pipe insulation was recently selected for the process lines of a huge new industrial plant. Method used to compare various insulations was TEVA (Thermo-Economic Value Analysis).* TEVA findings showed that 1½" Snap*On was *thermally more efficient* than 2" of the compared insulation, and thus $10,140 could be saved on material alone. Application savings, based on actual time studies, were estimated at 15%-20%. Operating savings of 3.6 billion Btu/year were calculated to result in an additional annual saving of $1836.

*TEVA (THERMO-ECONOMIC VALUE ANALYSIS) IS AN EXCLUSIVE G-B SERVICE, YOURS FOR THE ASKING. FOR TEVA SERVICE, CALL YOUR LOCAL G-B DISTRIBUTOR (Listed in the Yellow Pages in 72 Cities)

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been put up near coal basins and iron ore deposits — and will be similar to American and British seaside plants.

The first construction will be a single blast furnace with a production capacity of 1200 to 1500 tons daily, which is two to three times greater than that of the ovens in Lorraine. It will be possible to put so large an ensemble into production because only rich ores from North and West Africa and South America will be used. Quays are being built to receive sufficient quantities of these ores.

The Dunkirk project is to be an integrated complex, consisting of Martin ovens and a rolling mill to make thick plate. A Thomas converter with the latest oxygen blower also may be built nearby.

A battery of 250- to 300-ton capacity Martin ovens will consume liquid pig iron, with a slight addition of scrap. This will make them superior to other French blast furnaces which are almost entirely charged with scrap iron.

A second blast furnace probably will be set up, once the first one and the rolling mill are in production. This would raise production to a million tons annually. The rolling mill, meanwhile, is being built to consume about a million tons of steel a year.

Lignin in Tire Manufacture

Experiments by Canadian Government and private research agencies have shown that lignin — the substance that nature produces to hold wood fibers together — can be used to give longer life to tires, particularly the large-diameter tires used in military vehicles.

In road tests these tires, having synthetic rubber treads reinforced with lignin, showed 15 percent more resistance to wear than conventional tires.

Under present conditions, the larger the tire, the more natural rubber must be used in its construction because synthetic rubber becomes too hot at high speeds. However, in laboratory tests synthetic rubber reinforced with lignin develops less heat than conventional synthetic rubber, and the success of these experiments suggests that all-synthetic large-diameter tires eventually may make use of lignin.

The lignin used in these tests is a by-product of alkaline pulp manufacture and, as such, has a production potential in North America of 8,000,000 tons a year.

Since Canada manufactures synthetic rubber as well as paper, this industrial application of lignin is aimed at making Canada virtually independent of outside sources for tire raw materials.

Texas to Costa Rica Road Open

The Inter-American Highway will be open to traffic in January for 2725 miles from Laredo, Texas, to San Isidro, in southern Costa Rica. The Bureau of Pub-



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Low-cost insurance against power failure

Kohler electric plants fill the vital need for reliable, automatic stand-by power when storms or accidents cut off central station power.

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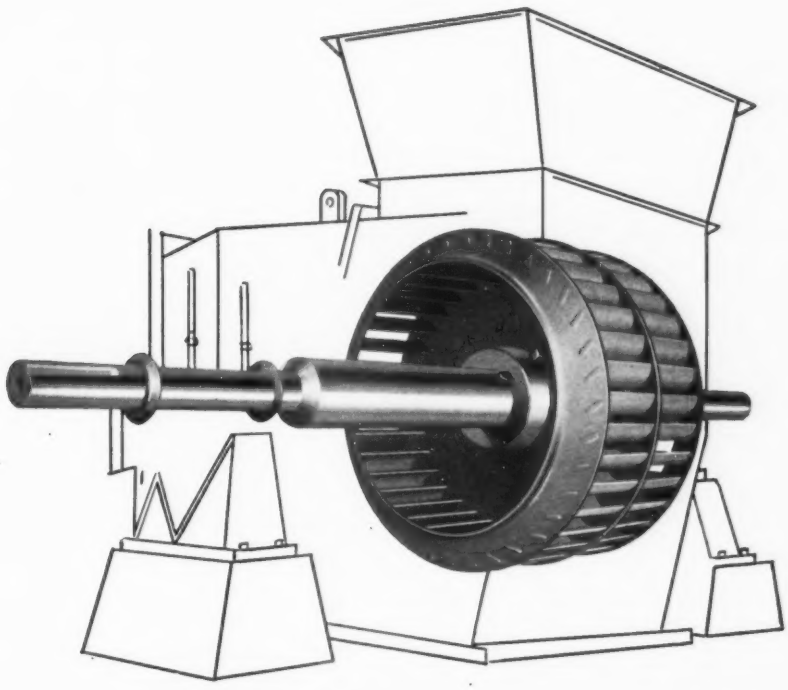
Complete manual, including suggested specifications, will be sent on request . . . Sizes from 500 watts to 50 KW, gasoline . . . 10 KW to 50 KW, diesel. Write Dept. B-26.

Model 35R81, *35 KW, 120/208 volt AC. Remote starting.*

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IN INDUCED DRAFT WHEEL DESIGN

36 radially deep, aerodynamically curved blades impart a dynamic energy to the gas stream to achieve low tip speed operation.

Unique shape of the blades and rims minimizes shock losses and turbulence at the entering edge of the blades and between the blades.

Wheel design assures relatively low moment of inertia (WR^2).

Wheel is constructed with a heavy forged steel hub and a sturdy centerplate.

All welded construction of the wheel provides ample shear strength, tensile strength, and rigidity.

These are only a few of the features that make Clarage's new Type DN Dynacurve Fans fully equal to the most punishing demands.

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CLARAGE ... *dependable equipment for making air your servant*

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lic Roads forecasts that by early 1959 the entire highway from Laredo to the Panama Canal should be open for 3200 miles. The Pan-American Highway (of which the Inter-American Highway is a part) will eventually enable a motorist to drive from Alaska to southern Argentina.

Modernize Belgian Canal System

A $106-million program has been blocked out by the Belgian Government to improve the Charleroi-Clabecq Canal and for modernization of this whole canal system. The canal links coal and steel industries in southern Belgium with Brussels and Antwerp, which is the country's largest ocean port.

The modernization project will include the widening of parts of the present canal and excavating a new channel for the remainder to eliminate many curves. The number of locks will be reduced from 30 to 4 over a total length of 29 miles. In addition, a 1000-meter tunnel will be replaced by a deeply excavated open canal and hydraulic barge lifts or similar devices will be installed to overcome a difference in water level of 68 meters.

The section between Charleroi and Clabecq is probably the most troublesome bottleneck in the system. Barges of 1350-ton capacity can operate all the way from Clabecq to the sea, but south to Charleroi the maximum capacity is only 300 tons.

Much of the Belgian canal system was built in the 19th century. Although a substantial part since has been modernized, many important sections still are obsolete. They cannot handle large barges, and traffic is hampered and made more expensive by many curves and hand-operated locks and bridges. An efficient system of inland water transportation is of particular importance to Belgian heavy industry, since many of the country's steel plants, heavily dependent on raw materials not produced locally, lie at some distance from the sea.

Iraq Invites CE's Inquiries

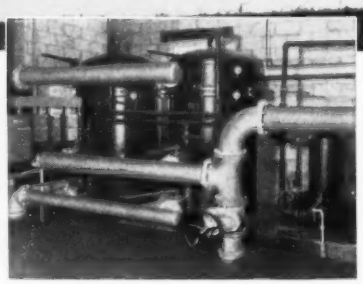
Consulting engineers wishing to be considered for employment on various projects being undertaken under Iraq's large development program may register with the Iraq Development Board, Ministry of Development, Baghdad, Iraq, requesting that they be registered and enclosing a brochure or other descriptive literature concerning their experience and qualifications.

Germans Produce "Steam Motor"

A German engineering company, Spillingwerk G.m.b.H., of Hamburg, has combined features of the steam engine and the diesel engine to produce what they call a steam motor.

Other engine designers have tackled this problem in the past,





Shown above is the beautiful Oxon Hill Country Club Pool, Oxon Hill, Maryland which uses an Adams 1-SPF-169 filter to handle the almost 200,000 gallons capacity. Ted Messenger and Associates, Washington, D.C., were the consultants.

Adams SPF swimming pool filters are available in sizes from 53 to more than 1000 square feet of filter area. Normally all sizes can be shipped from stock. A typical unit is shown at the right.

Sorry . . . but we do not offer filters for your client's backyard pool.

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ADAMS SWIMMING POOL FILTERS

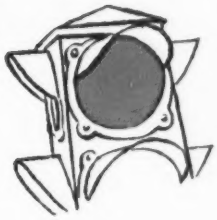
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Complete details are furnished in our new technical Bulletin 626. This bulletin was prepared with you specifically in mind. Why not write today . . . on your letterhead, please . . . and we will send it to you promptly? Your client deserves the best you can specify.

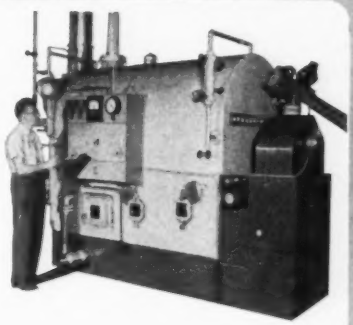
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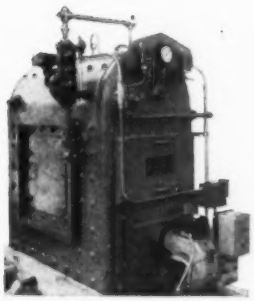
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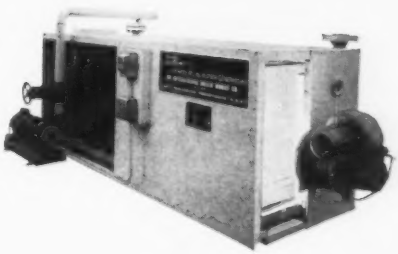


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First FORCED RECIRCULATION package unit that actually requires LESS HEADROOM than modified scotch package boilers. Famous LA MONT boiler design specifically adapted for SINGLE BUILDING low or high temperature water heating systems.

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but the resultant steam engine's performance suffered considerable loss of efficiency.

Since it is the exhaust and inlet valves that are particularly liable to give trouble, the steam motor is equipped with piston-valve control. A very low piston speed was adopted for the steam motor to make it a highly wear-resistant engine. The rotating camshaft of the diesel motor was adopted to avoid the disadvantages associated with the backward and forward movement of rods and intermediate levers.

Particular attention was paid to balance of free inertia actions and moments, which make it possible to operate the motor on upper floors and next to residential blocks and offices and other places susceptible to vibration.

The main feature of the Spilling steam motor, however, is its backbone, which endows this steam engine with the character of a diesel engine. The crankcase unit is machined in one chucking operation and in one single working operation from all sides. In this way position and alignment of all crankcase unit components are mechanically fixed so that one is exactly identical to the other.

In contrast to other steam engines, the steam motor has cylinders arranged vertically, not horizontally. This permits additional units to be combined with an existing one to give more power. This means that it is no longer necessary to choose engine performance to include an emergency reserve of power. The steam motor, with its easy addition of extra units, is able to grow with the requirements of the plant, up to a maximum of six cylinders.

One outstanding economy factor claimed for the steam motor is that it can be operated on a wide variety of cheap and waste fuels — such as peat, inferior brown or slack coal, or oil carbon.

Largest Sugar Silos

AB Armerad Betong, of Malmo, Sweden, has built the world's largest sugar concrete silo at Kopingebro. The construction included two round silos of hydraulically prestressed concrete blocks on a 13-ft deep mixed clay and sand foundation; an elevator tower with a curved top; and the necessary overhead transportation equipment and covered platform. In over-all dimensions, the silos are 89 feet high with an outside diameter of 115 feet.

Work was supervised by the Halsingborg office of Kjessler & Mannerstrale AB, Swedish consulting engineering firm.

Rome Airport Nears Completion

Construction of a second 9840-ft runway for the new Rome International Airport, at Fiumicino, is now almost complete. The first 9840-ft runway, 270 feet longer than that at London Airport, hitherto the longest in Europe, is

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144 pages of technical data on recorder installations, plus a wealth of hydraulic tables and conversion tables. $1 copy. (No COD's.)

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to move bulk materials with an *Airstream* Conveyor

Sleek, slim pipelines typify streamlined bulk handling with Dracco Airstream Conveyors. From intake point to destination, pipelines are all that can be seen. They run on or just underneath the roof . . . underground . . . up the sides of buildings . . . between or through walls . . . around corners.

If you're planning on modernizing your plant, take a step in the right direction by modernizing bulk handling first. You can create breathing space for new equipment by replacing cumbersome mechanical conveyors with a space-saving Airstream system. Pipelines easily adapt to new or existing plant layout. Costs shrink, too, as manual handling is eliminated, labor and maintenance expenses minimized.

At the intake point, a hopper or nozzle receives materials from boxcars, hopper cars, trucks, barges, bags or storage bins. Part-time supervision of one man is usually all that's needed. Air does the handling, moving materials swiftly and without dust, waste or contamination to storage bins or process.

Engineers from Dracco will be glad to discuss materials handling problems with you at your convenience. For more information, call or write today.

DRACCO DIVISION OF FULLER CO.
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New 32-page brochure presents detailed information on how Dracco Airstream Conveyors have solved bulk materials handling problems. Write for Bulletin 530.

DRACCO *airstream* conveyors
dust control equipment

already finished. The new airport will replace the present international airport, at Ciampino, which is now too small and congested. It stands on the site of the Emperor Claudius' harbor at Ostia, which carried the bulk of the Roman Empire's overseas trade.

A swamp until 25 years ago, the area was drained by Mussolini. The airport, which is 16 miles from Rome, will cover 3707 acres. The runways are free of take-off and approach obstacles for a radius of seven miles in all directions. No date has been set for opening the airport.

Plan Ore Transport System

Deposits of manganese ore to be opened up near Francheville in the heart of Gaboon, French Equatorial Africa, are described as among the richest in the world. More than 100-million tons of ore are in sight and it is planned to produce 500,000 tons a year (worth $24 million), but the first problem is to get the ore out of the heavily forested mountains near the Equator to the sea. A Franco-American company, Compagnie Miniere de l'Ogooue, in which U.S. Steel Corp. has a 49-percent interest, has agreed with the French authorities to construct a cableway, more than 40-miles long, across the mountains, and a railway 160-miles long to link the southern end of this cableway with the Brazzaville-Pointe Noire railway line, near Dolisie. Though construction work has begun, the company does not expect to start exporting manganese from Pointe Noire harbor before 1960 or 1961.

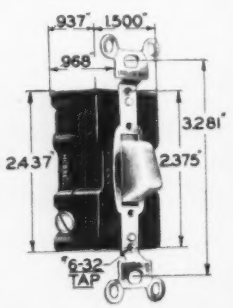
Fresh Feed Water from the Sea

Despite the extensive program of construction of water reservoirs and artificial lakes the water shortage in the USSR is becoming steadily worse. Efforts to obtain from sea water fresh water of a sufficiently high standard of purity to be used in high-pressure boilers has for a long time been unsuccessful from the commercial point of view. However, Soviet engineers now are credited with developing a process of purifying sea water by a thermo-chemical method that ensures almost complete purity. First lime is added to sea water in the proportion of two kilograms per ton of water. This precipitates all the magnesium salts in the form of magnesium oxide and at the same time saturates the water with gypsum. This water is heated to 160 C, at which temperature practically all the gypsum settles. After the water is filtered it can be fed to evaporators operating at any pressure and to steam boilers operating at low pressures, with no resultant scale formations.

The method requires an insignificant amount of lime and yields such valuable by-products as magnesium oxide, gypsum, and sodium chloride. ▲▲

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with thru-connection
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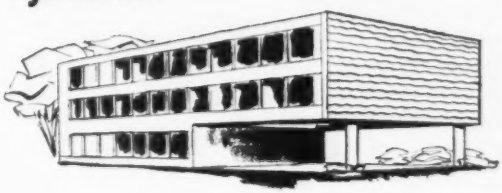
Introducing "Presswitch", the revolutionary new Hubbell press-type A.C. switch . . . a press, it's on; a press, it's off . . . the smoothest, most convenient and most efficient A.C. switch in Hubbell's famous switch family. "Presswitch" responds to the gentlest press or touch of the finger or nudge of the elbow. It is as much at home in a factory as in a living room. Its attractive styling blends with any interior and its rugged, precision molded construction represents a new standard of durability and dependable operation.

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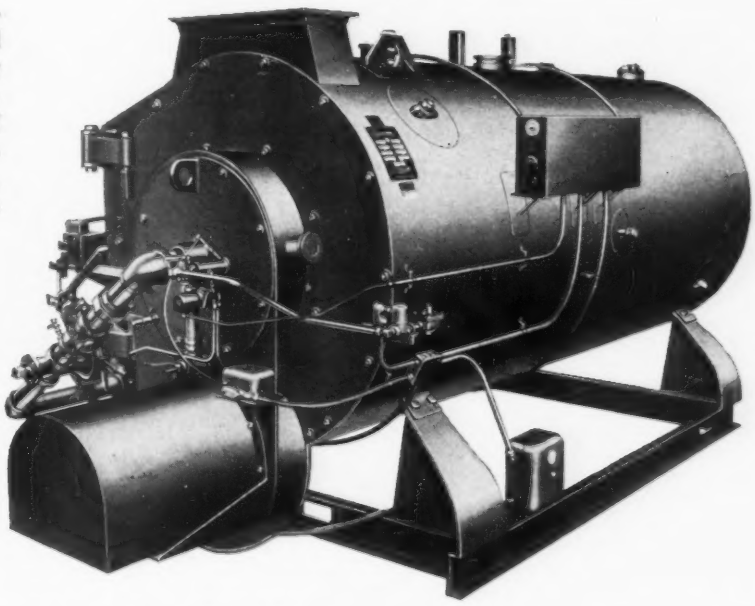
The only Package Hot Water Generator designed exclusively for Forced Circulation Hot Water Systems!



Here's why the new Cyclotherm Hot Water Generators are the biggest step forward in many years of hot water generator efficiency:

1. Internal design distributes water evenly to all of the effective heating surface.
2. At the same time, Cyclonic Combustion—Cyclotherm's patented combustion method—distributes heat evenly throughout the combustion chamber.
3. It is the combination of a controlled, directed flow of water with a controlled, directed flow of heat that puts these hot water generators so far ahead of the field.
4. Minimum operating efficiency of at least 80% is guaranteed without qualification.
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No other package generators incorporate these principles of design. Built exclusively for forced circulation hot water heating systems, they have broken entirely away from principles of steam design that are not applicable to hot water production. Write today for descriptive folder No. 34.



YEARS AHEAD IN STEAM GENERATION

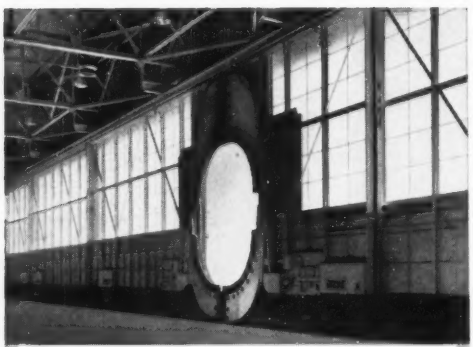
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On the basis of hangar building costs—and particularly where large airplanes must be provided for—the Byrnaperture makes possible exceptional economies. This has been definitely proved in every case where Byrne has built doors incorporating this feature.

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News for the Consultant



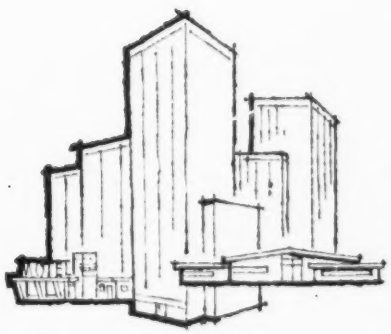
Helicopter Brings Buckets of Bolts to Becket's Building

Final key steel beams went into place on the last day of 1957 on the highest points of the 42-story Southland Center building in downtown Dallas, as workmen topped-out the tallest building west of the Mississippi River. Exactly two years before, on New Year's Eve, 1955, groundbreaking ceremonies were held.

Gilded high-tensile steel bolts were delivered by helicopter for use in securing the final steel beam in the building. Helicopters similarly delivered a gilded groundbreaking shovel on December 31, 1955, and the first keg of high-tensile steel bolts when steel was erected in the excavation on January 24, 1957.

Southland Center, due for completion in early 1959, is to become the national headquarters for the Southland Insurance Company. Exteriors of the buildings will feature brilliant blue and green Italian glass mosaic tile with vertical strips of charcoal anodized aluminum.

A prominent feature of Southland Life Tower will be the thirty-sixth and thirty-seventh floors,



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More products to give your ideas greater scope. From Honeywell you get a great variety of products both mechanical and electrical. Honeywell is the only company that makes a complete line of pneumatic, electric and electronic controls plus instrumentation for commercial buildings. With Honeywell your choice is wider, your ingenuity less restricted.

More ideas that go with yours. Honeywell has pioneered the concept of central-systems control for commercial buildings, now the accepted trend. This and other Honeywell ideas have increased recognition of the importance of operational equipment, and helped to make your contribution bigger, better and more important.

More support. Honeywell works with you on every job, frees you from annoying details, saves you time, even helps you sell. And the assistance of Honeywell specialists in each of 112 offices throughout the country is as near as your phone.

Look over the Honeywell products and ideas on the following pages. And, remember, each is backed by the kind of support that only Honeywell can offer you.

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which are cantilevered out eight feet from both sides of the face of the building. These two floors will be devoted to private club and restaurant facilities, with kitchens on the thirty-eighth floor. Mechanical equipment for the building will be housed on the thirty-ninth and fortieth floors.

The forty-first floor will feature a public observation deck. Topping the entire structure will be a heliport available for use by business firms in the building.

Southland Center will be served by 38 electronically-controlled high speed elevators and 10 escalators, plus freight and service elevators.

Extending below the surface 55 feet, basement facilities will provide a garage capable of handling 2500 cars per day on three subsurface levels. Fourth and fifth basement levels will handle central plant mechanical equipment and miscellaneous facilities.

Occupying a full city block in downtown Dallas, the center was planned by Welton Becket and Associates, Dallas architects and engineers. Consulting architect is Mark Lemmon, of Dallas.

Welton Becket heads a firm of architects and engineers with more than a quarter-century of architectural experience on over 1500 widely varied projects, including structures in England, Cuba, Brazil, Egypt, Mexico, Hawaii, and the Philippines, as well as all parts of the United States.

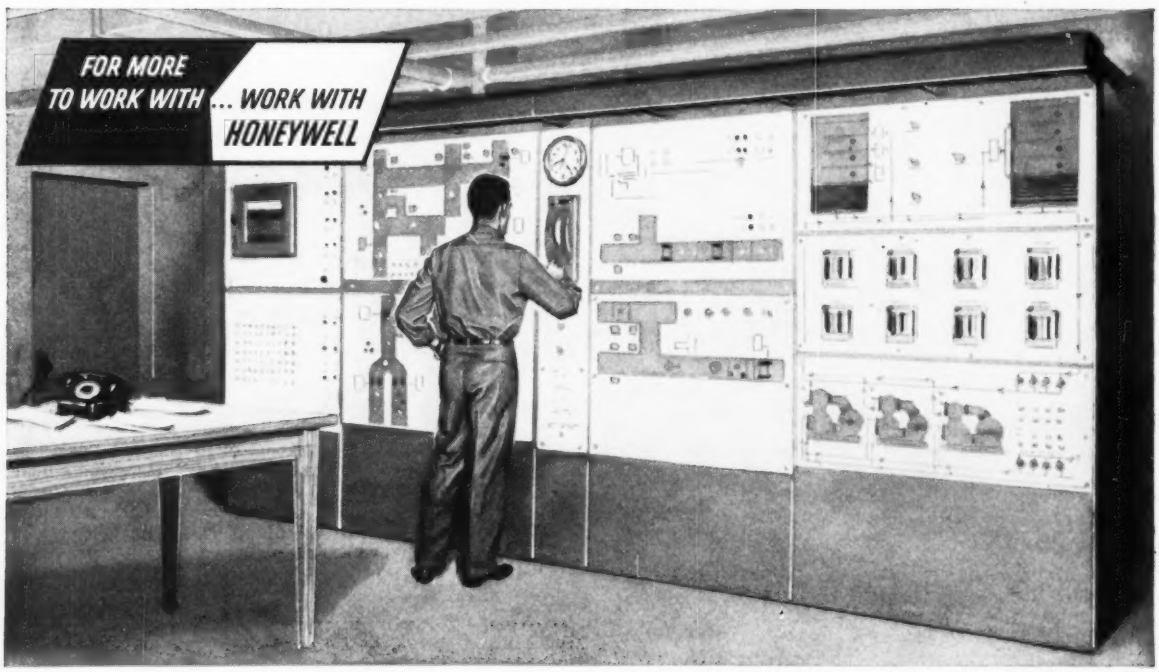
Earthquake Hazard to Reactors Under Study

Effects of earthquakes on nuclear power reactors is the subject of a year-long study by the Lockheed Missile Systems Division, Palo Alto, and Holmes & Narver, Inc., Los Angeles engineering and construction firm, according to an announcement by the U.S. Atomic Energy Commission.

According to James T. Holmes, president of the Los Angeles firm, Holmes & Narver will carry prime responsibility for structural and siesmic analysis, while Lockheed will study design problems of nuclear reactors themselves. Dr. George W. Housner, president of the Earthquake Engineering Research Institute and professor of civil engineering and applied mechanics at California Institute of Technology, is acting as consultant to Holmes & Narver on seismology.

The study is expected to evaluate earthquake hazards to major types of stationary reactors and to develop criteria for inclusion in design requirements to minimize or eliminate hazards. Results of the study will be published in an AEC handbook for the guidance of industrial firms interested in the design and construction of large reactors.

Holmes said the study marks the first major assignment for the Holmes & Narver nuclear division, most recent addition to the diversified services of-



Supervisory Data Center for the Philadelphia Transportation Center, a unique 18 story building which includes offices, stores and a bus terminal. It is another in the long list of buildings to use a Honeywell Supervisory DataCenter to centrally control its entire year 'round air conditioning. Owner and Builder: McCloskey & Company; Architect: Vincent G. Kling; Mechanical and Electrical Engineers: Robert J. Sigel, Incorporated; Structural Engineers: McCormick & Taylor Associates.

fered by the firm. The new division, headed by Kelly McBean, specializes in the analysis and correction of all types of safety hazards surrounding peacetime uses of nuclear energy. For the past ten years the firm has managed the giant Eniwetok Proving Ground for the AEC and has played a major role in the development of the test site near Las Vegas.

Long Beach to Get New Gas Facilities

The City of Long Beach, Calif., Gas Department plans to construct new compressor plant facilities and a gas holder to serve the easterly portion of the city. This will tie into the present distributing system. M. A. Nishkian, Long Beach consulting engineer, will design the project.

Located off Carson Boulevard in the Heartwell Park property, the facilities will include a main building with porcelainized aluminum exterior panels and curtain wall design. An octagonal floor plan provides for four, main, 550-hp, gas engine-driven reciprocating compressor units, together with the necessary auxiliary equipment.

Offices, control room, and wash rooms will be in a lower structure attached to the main building. The site will be fully landscaped to blend colorfully with the proposed new Heartwell park, which will be adjacent to the new Southern California plant.

The unusual octagonal design features a ten-foot diameter sphere in the center for the compressor gas suction and a 'doughnut' type ring header surrounding the sphere for the discharge side.



PROPOSED NEW LONG BEACH GAS FACILITIES.

A central instrument recording and indicating panel will control the entire plant automatically through the use of pneumatic type controls. There will also be an electrical supervising control selec-

*Honeywell Supervisory DataCenter**

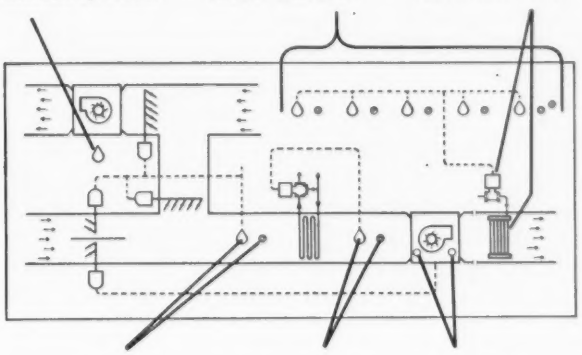
One-man control of a building's entire air conditioning system

Details from just one module of the Supervisory DataCenter in the Philadelphia Transportation Center

A. Exhaust air fan switch. Pilot light indicates operation.

B. Temp. selector knobs and check buttons for each zone.

C. Symbol for steam valve and reheater coil for each zone.



D. Temperature selector knob and check button for the mixed air temperature.

E. Temperature selector knob and check button for air leaving cooling coil.

F. Start-stop buttons for supply air fan. Pilot light in symbol indicates operation.

The DataCenter shown here is an example of the centralization of control for year 'round air conditioning systems. This panel enables one man to check and adjust the temperature at all important points. He simply pushes the check button and reads the temperature on the large indicating dial in the center of the panel. Chilled water, condenser water and cooling tower pumps, compressors, fans and valves can be operated right from the panel. System malfunctions are quickly observed and analyzed right from the panel. Repair crews can be sent to the trouble source.

A systems control center like this can give your clients more efficient operation of their air conditioning system. Honeywell can also include such other functions in your centralized panels as communications, record keeping and alarm and detection systems. A Honeywell specialist will work with you in designing a center to fit your clients' needs. *T. M.

Honeywell

First in Controls

tor panel so the operator can remotely open and close individual valves or groups of unattended valves located as much as two miles away.

The supervisory control system transmits coded pulses or tones through leased telephone lines to the remote valves.

A 5-million cubic foot gas holder will be erected on the site to store excess gas during off-peak hours.

Formal award of all construction contracts will take place in the early spring of 1958.

The Nishkian firm recently designed and engineered the new Needles compressor station at Needles, Calif., for the Southern California and Southern Gas Companies and is identified with a long list of major engineering projects of this type.

Rader Designs Small Sewage Treatment Plant

Rader and Associates of Miami have designed and supervised construction of one of the smallest and most unusual sewage treatment plants in the country. Built recently at the northwest edge of Delray Beach, Fla., for the Delray Shores Water Co., this plant is designed to serve over 200 homes at the rate of 350 gallons per house per day.

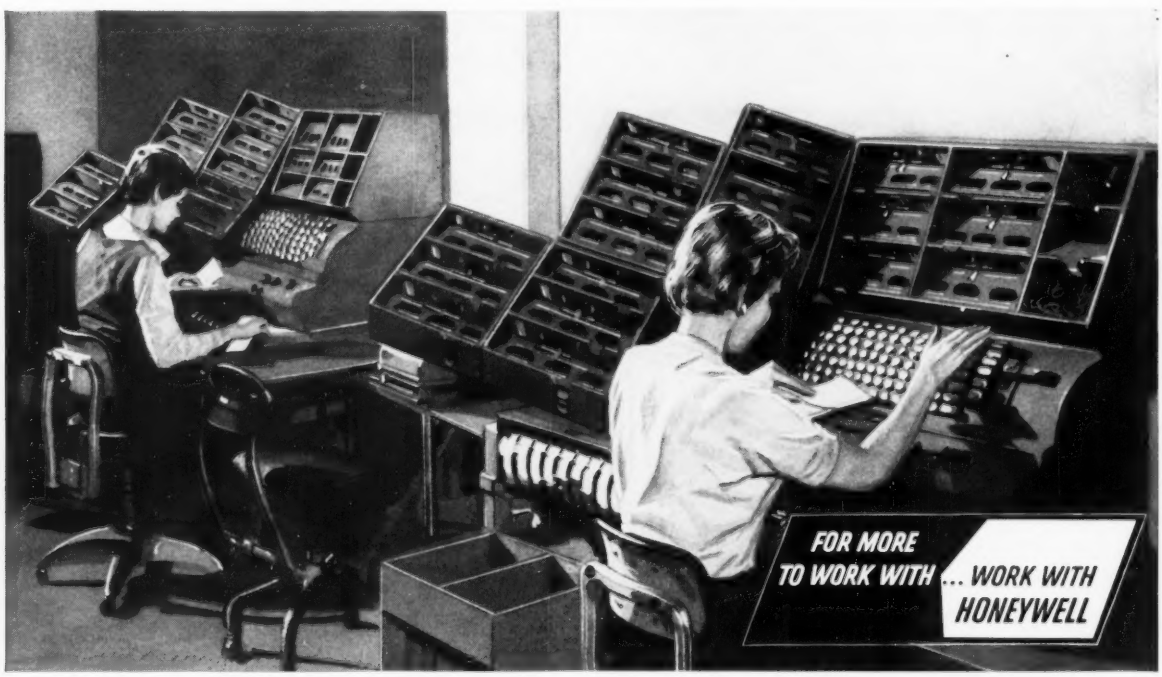
This economical sewage treatment plant promises to be a boon to housing project developers. The plant is simply and economically constructed of concrete blocks, thus minimizing structural costs and dispensing with a ton of miscellaneous iron and steel. The low cost design is approved for regular service of 200 houses, but it can serve 400 to 500 houses temporarily while additional facilities are being provided.

Its compact size cuts both construction and equipment costs with no loss in efficiency. The equipment involves only three pumps, one chlorinator, dosing nozzles, and piping. Sludge collecting mechanisms from the clarifiers, rotary distributors from the trickling filter, and the cover from the digester all are among the items eliminated.

Rader and Associates also designed the water system, sewage pumping station, water distribution, and sewage collection systems for the project.

Meeting Discusses Mexican Earthquake

A joint meeting was held on January 8 by the Structural Engineers Association of Southern California and the American Society of Civil Engineers to hear reports from structural engineers on observations of the recent Mexico City earthquake. Joseph Sheffet, 1958 SEAOSC president, was ho[illegible] for the meeting, which attracted a total of nearly



Electronic Air Cleaner Installation in the Lake Street office of the Northwestern National Bank, Minneapolis, Minn., has in just five months brought a reduction in cleaning, decorating costs, has also reduced maintenance for such delicate working mechanisms as these proof machines.

Bank Mgr.: Leroy H. Berg; Arch. and Eng.: Magney, Tusler & Setter; Gen. Contractor: George W. Madsen Construction Co.; Vent. & Air Conditioning Contractor: O'Brien Sheet Metal Works; Elect. Contractor: Harris Brothers Plumbing Co.; Plumbing & Heating Contractor: J. McClure, Kelley and Co.

400 members from both of these engineering groups.

John M. Sardis and G. W. Houser, two of the speakers, were on vacation in Mexico City when the disaster occurred. Mr. Sardis, who was asleep on the eighth floor of the Reforma Hotel when the earthquake struck, reported that the quake sounded like thunder. The building cracked and groaned and swayed noticeably. Observations the following day showed that the Hilton Hotel was not as fortunate as the Reforma; many of its unreinforced filler walls had fractured and collapsed. Many of the buildings that collapsed were of inadequate design for their vertical loads, offering little additional resistance to the earthquake.

It was Sardis' conclusion that the seismic design coefficient is not as important as properly designed and executed details; unreinforced masonry is unsatisfactory in an earthquake area; the structural frame of a building should be of a high strength ductile material that can take an overstress.

Prof. Martin Duke of UCLA discussed foundation conditions as related to the Mexico City earthquake and the effects of the quake in other areas of Mexico. He pointed out that Acapulco, only 50 miles from the epicenter of the quake, suffered only minor damage, while Mexico City, 170 miles from the epicenter, was damaged heavily. The reason appears to be due to foundation conditions, since Acapulco is built upon granite while Mexico City is founded on unconsolidated clays and silts.

Murray Erick spent four weeks in Mexico studying effects of the earthquake. He listed some of the causes of building failures as: substandard qualities of materials and workmanship; many irregular buildings producing excessive torsional forces; insufficient separation between structures so that one building pounded against another; unreinforced masonry walls not tied into the structure; poor structural design; and bad foundation conditions. He felt that for tall slender buildings, a portal frame structure is the most desirable and that nonstructural elements should be isolated from the frame so that the frame could deflect independently.

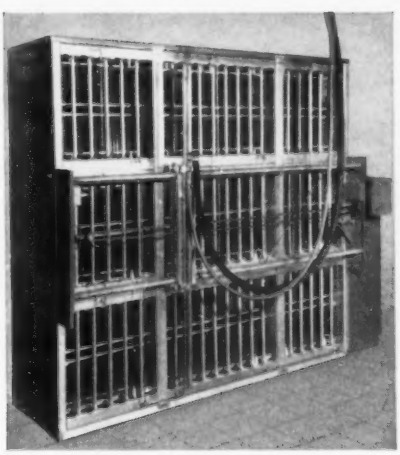
Gilbert E. Morris, superintendent of building, City of Los Angeles, came to the conclusion, after reviewing the effects of this earthquake, that the Los Angeles building standards are not too severe but very sound.

Prof. G. W. Housner, California Institute of Technology, noted that the magnitude of the 1952 Tehachapi, Calif., earthquake was about the same as the 1957 Mexico City earthquake.

R. W. Binder pointed out that the 43-story Latino-Americana building, designed by Mexico City Consulting Engineer Zeevaert, was not structurally damaged. Dynamic analysis had been used in the design

For your mechanical systems... Honeywell's Electronic Air Cleaner

eliminates dirt six times more effectively than ordinary filters.*



EASY INSTALLATION of Field Assembled models is provided by match-marking at factory, regularity of cell building blocks and detailed instructions provided with each model. Modular construction allows fabrication in almost any size.

The Honeywell Electronic Air Cleaner gives your clients reduced cleaning and decorating costs, reduced maintenance for machinery, better health and comfort for personnel. And it very often reduces heating and cooling costs because the amount of outside air taken into the building can usually be decreased.

Two types of Honeywell Electronic Air Cleaners are available to fit any air conditioning or ventilating system: Field Assembled models which are built and tested at the factory, disassembled and shipped to job site for erection in the ductwork; and Custom Package models, built with a package-enclosure, tested and shipped completely assembled for installation.

For expert information and assistance in specifying, or installing Honeywell Electronic Air Cleaners, call the Honeywell office nearest you. Or write Honeywell, Dept. CO-3-32, Minneapolis 8, Minn.

**According to tests developed at the National Bureau of Standards.*

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of this structure, and there were no partitions for damping.

New "Inverted Umbrella" Roof For College Library

The nation's first educational building to feature hyperbolic paraboloid roof design — a thin shell structural form that resembles an umbrella blown inside out — is now being built on the Bronx campus of Hunter College, New York, N.Y.

Designed by architect Marcel Breuer, the new 120- by 180-ft structure will be a dramatic looking 230,000 volume library, to be completed in 1959.

Its intricately curved roof will be supported by six columns, one serving each of the 60-ft by 60-ft inverted umbrella shapes. The large interior spaces provided by the long spans will afford minimum obstruction of view with maximum floor space.

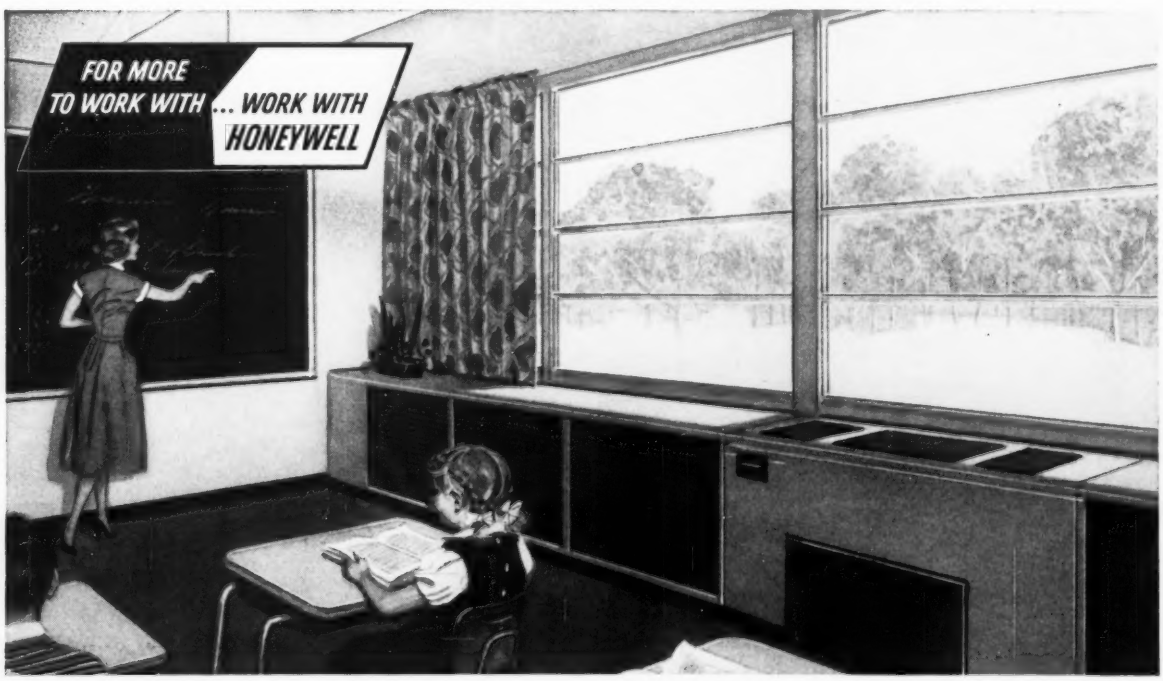
Efficient insulation of the hyperbolic paraboloid roof is a difficult problem. Rigid insulation materials were immediately eliminated because they lacked the flexibility required. Instead a concrete mixture made with perlite — an expanded volcanic mineral that is rapidly gaining wider usage as an aggregate in lightweight insulating concretes — was specified.

A 3-in. layer of perlite concrete, to be placed over the 3½-in. concrete shell, has a U value of 0.145, which is equal to 35 inches of ordinary structural concrete. Above the perlite insulating concrete, mineral surface roll roofing will be placed in alternate light and dark grey strips. For drainage, the supporting columns will have hollow cores that open to the roof.



ABOVE—NEW HUNTER COLLEGE LIBRARY
BELOW—LIBRARY AND ADJOINING BUILDING

A companion classroom-administration building



The Unit Ventilator System of heating, cooling and ventilating permits an ideal thermal environment particularly valuable in schoolrooms. In addition, the system gives protection against window down-draft without expensive auxiliary radiation or extra piping. Adjoining cabinets in this installation are used as bookshelves.

will be connected to the library. It has 30 classrooms and a secluded inner courtyard that will provide space for faculty events. In view of the relatively small spans desired, conventional loadbearing masonry construction was specified.

While the hyperbolic paraboloid shapes of the library will contrast vividly with the flat roof of the classroom-administration unit, both structures will feature similar facades on the two sunny sides. Honeycombed sun-control grilles made of 12-in. by 12-in. terra cotta flue tiles will be set four feet in front of all-glass walls to provide effective shading yet permit straight-through vision. The remaining two walls of each building face northeast and northwest and therefore will not require sun protection.

The modern new structures will harmonize pleasantly with the four existing Gothic-style buildings on the campus.

Structural engineers for the Hunter College Library are Farkas and Barron, New York; mechanical engineers are Falotico and Associates.

Vietnam Airport Engineer Studies at Rader

Nguyen Xuan Hieu, chief engineer for the Saigon-Tansonnhut Airport, has been studying airport planning, design, and construction at Rader and Associates, Engineers and Architects, Miami, Fla. Mr. Hieu is in the midst of an intensive five month training program, the result of a mutual agreement between the United States and Vietnam. The training course is sponsored by the International Cooperation Administration and the Civil Aeronautics Administration of the U. S. Department of Commerce.

Vietnam is soon to undertake the expansion of the international airport at Saigon, and Mr. Hieu will be the engineer in charge of this project. This will involve construction of a new 10,000-ft runway to accommodate jet airliner traffic, a new terminal building for both domestic and international travel, and parking facilities for both airliners and passenger cars. The airport currently has two runways of 8000 and 6000 feet, and work is soon to begin on lengthening of the shorter runway.

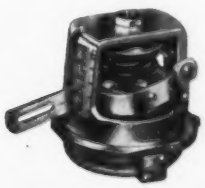
Since his arrival in the United States, Hieu has studied airport planning and design in Washington, Atlanta, and Memphis. He was in Miami four weeks before going on to Washington, Chicago, Milwaukee, Peoria, and New York City. After completing this itinerary, he will return to Washington for a two week period in the CAA Office of Airports, conferences with ICA officials, and preparation of final reports. The training period will end on March 14. Mr. Hieu then will return to Saigon and undertake the engineering phases of the expansion program

For your mechanical systems . . . Honeywell's Unit Ventilator Team

Eliminates hot and cold blasts, gives better unit ventilator performance

This Honeywell control team of air stream thermostat, valve, damper motor and room thermostat exclusively developed for unit ventilators, levels the peaks and valleys of heat and cold so troublesome in high occupancy areas such as schoolrooms.

Air temperature delivered by the ventilator changes only as a result of change in room temperature. Cycles of hot and cold are sensed by the air stream thermostat and corrected before they start. All members of the "team" work together smoothly and efficiently. For full information, call your local Honeywell office, or write Honeywell, Dept. CO-3-32, Minneapolis 8, Minnesota.



M0516 Damper Motor. Rolling diaphragm reduces friction, gives more precise position. Diaphragm prevents sticking, thus adds to modulated action of the control team.



V0512 A Valve. High temperature rolling diaphragm combined with low friction Teflon cone packing gives improved modulation, eliminates jerky step-by-step action and gives smooth positioning.



L0907 Air Stream Thermostat has fast response and fewer moving parts. Working with the room thermostat, it resets the air temperature delivered by the ventilator.



T0901A Pneumatic Round is the most accurate schoolroom thermostat available today. Low mass bimetal for fast response. Easy to calibrate and adjust.

Honeywell

First in Controls

at the airport, which services a city with two-million population.

Fresh Approach to Engineering Education

A number of the nation's top engineering schools are quietly pushing through major curricula changes aimed at turning out better scientists rather than industry-orientated engineers, according to a recent story in *The Wall Street Journal.*

The schools reason that today's engineer is poorly equipped to keep pace with a rapidly accelerating technology. By adding courses in physics and mathematics at the expense of vocational courses, the colleges hope to remedy this deficiency.

The Task Committee on Professional Education, American Society of Civil Engineers, in a recent report, came up with substantiating views on engineering education. Stating that mathematics and the physical sciences are fundamental to civil engineering, this report strongly recommended that unessentials be eliminated and needless repetition be avoided. It also pointed out that experiments in engineering curricula should be encouraged.

Among the schools involved in this revised approach to engineering education are Brown University, Columbia University, Massachusetts Institute of Technology, and California Institute of Technology.

In M.I.T.'s electrical engineering department, a course in electrical machinery has been replaced by a course on the interaction of magnetic fields. In M.I.T.'s metallurgical engineering department, a course in the forming and rolling of metals was dropped recently. In its place was substituted a course in the physics of metals.

The reason behind the changes, say many of the country's foremost engineering educators, is the need for more creative people who will be capable of pursuing what Gordon S. Brown, head of electrical engineering at M.I.T., calls the "open ended" approach. Comments Dr. Brown: "We've got to put more imagination into engineering because it's only imagination that is going to give our engineers the answers to today's scientific problems."

Big Los Angeles Sewer

Rapid progress is being made on the $60 million Hyperion sewerage program for Los Angeles. Of the eight major features designed by Hyperion Engineers, the sludge pumping plant and sludge ocean outfall are substantially complete; the North Central outfall sewer — Units I and II — are nearing



In the Sequoia School, Manteca, Calif. natural daylighting really pays off with the Honeywell Light Saver. This phototube system automatically adjusts light intensity, assuring constantly correct lighting balance.

Architect: Mayo, Johnson & De Wolf, Stockton, Calif.; Elect. Eng.: Williamson & Vollmer, Oakland; Mech. Eng.: Keller & Gannon, San Francisco; Elect. Contractor: Collins Electric Co., Stockton.

completion; plant enlargements are about one-third completed; the effluent ocean outfall has been started; and bids have been received on the effluent pumping plant. Plant modifications have not yet been released for bids.

The plant enlargements and the North Central outfall sewer facilities will be available for use by mid-summer 1958, the effluent ocean outfall by the end of 1959, and the effluent pumping plant shortly thereafter. Minor design work yet remaining to be done by Hyperion Engineers includes float controls for the activated sludge tanks, certain modifications to the existing surge chamber, a storm drain, digested sludge treatment, and landscaping and irrigation.

Hyperion Engineers is a joint venture of Holmes and Narver, Inc.; Daniel, Mann, Johnson and Mendenhall; and Koebig and Koebig, all of Los Angeles.

Detroit's New Underground Garage

Detroit has gone underground to help ease its downtown parking problem. The new 1000-car facility, the Grand Circus Park Garage, consists of two separate reinforced concrete structures.

One unit, located on the east side of Woodward Ave., Detroit's principal thoroughfare, has three levels. The other has two levels and is located on the west side of the street. A vehicular tunnel extends beneath Woodward Ave. to connect the two sections. Grand Circus Park, a semi-circular horticultural showpiece, forms the roof of both structures.

Both sections of the garage have spiral ramps. The space inside the circumference of the ramps was used for heating and ventilating equipment rooms. By placing the equipment rooms within the ramps, space was saved to park 90 to 100 cars.

The Grand Circus Park Garage was designed and constructed for the City of Detroit Municipal Parking Authority by The H. K. Ferguson Co., Cleveland, Ohio.

Solid Electrolyte Capacitors

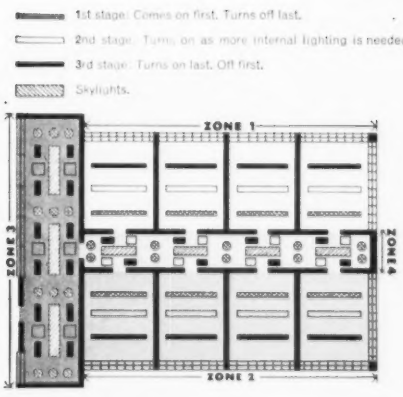
The use of solid electrolyte capacitors is increasing. They are the most important development in the condensor field since the introduction of the liquid electrolyte type, according to Dr. Robert S. Aries, consulting engineer, of Stamford, Conn.

Returning from a trip through Western Europe where he surveyed chemical and electronic installations, Dr. Aries said that the interest in the field is equal on both sides of the Atlantic.

Dr. Aries, who is connected with the Stamford

*For your Electrical Systems... The Honeywell Light Saver**

gives precise light control, helps cut electric bills up to 80%



HOW IT WORKS.

1. The building is divided into zones. All rooms in any zone have the same lighting requirements.

2. A Light Saver phototube accurately measures the amount of daylight entering each zone.

3. Each phototube's signal automatically operates a switching motor which decreases or increases a zone's artificial lighting, a little at a time.

4. When darkness is desired lights can be turned off with a manual switch. When switched on again, all lights return automatically to phototube control.

Here's a system that gives your clients the real benefit of modern daylighting, through the combined efforts of the architect, you and Honeywell.

The Honeywell Light Saver uses phototubes plus Honeywell precision switches and controls to supplement daylighting with perfectly balanced artificial lighting. Tests prove savings as high as 80% in electricity costs.

Its applications are numerous, especially in the school and institutional field. The Honeywell Light Saver can be used to control either fluorescent or incandescent lighting. And it's backed by years of testing and research plus the Honeywell guarantee. A Honeywell specialist will assist in applications, provide you with all the information you want for specifying. Call him at your nearest Honeywell office. *T. M.

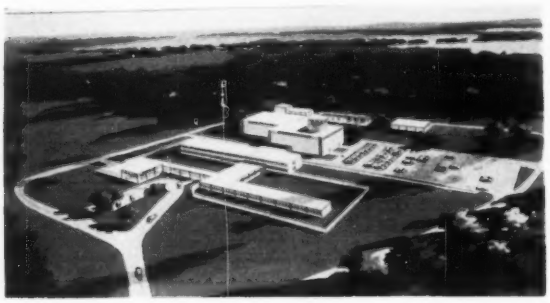
Honeywell

First in Controls

firm of Aries Associates, stated that in 1956 the production of these units was 350,000; in 1957 about 800,000, and an estimated 2 million will be made in 1958, 4 million in 1959, and 8 million in 1960.

New Thermonuclear Research Facility for Princeton

The master plan for the Model C Stellarator Project at Princeton University has been developed by Walter Kidde Constructors, Inc., engineers and builders, New York and Houston, under a contract awarded last summer. The facility is scheduled for completion about 1960. Here scientists and engineers will conduct research on controlled thermonuclear reactions, and future applications.



STELLARATOR PROJECT FOR PRINCETON UNIVERSITY

Under the same contract, Walter Kidde Constructors has completed engineering design of the office buildings and laboratory, and the boiler house and other service facilities.

Human Factors Important In Engineering

The popular image of the engineer as a cold man of facts and figures was dispelled in a discussion of the human side of engineering, during the Winter General Meeting of the American Institute of Electrical Engineers.

Lee A. Kilgore and V. B. Baker, of the Westinghouse Electric Corp., Pittsburgh, Pa., in their paper, *Human Factors in Engineering,* said that the technical side of engineering is "only half the picture, for everywhere he turns the engineer must deal with people . . .

"In this highly technical, industrial, and military world, the engineer is in a unique position to provide leadership," they said. However, while some engineers are natural leaders, many do not have the opportunities as they advance technically to develop attributes in the field of human relations which are necessary to successful leadership." ▲▲

For your Electrical Signalling System . . .

The Honeywell *Hotel/Motel Master puts up to 24 separate functions under one-man control**

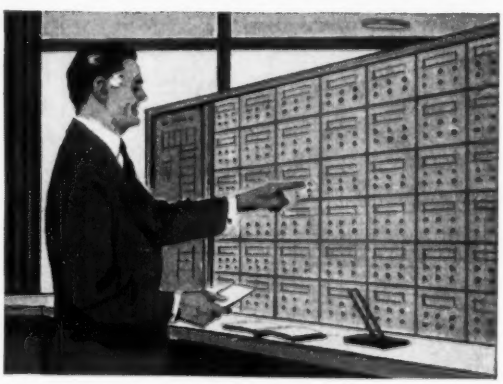
Already installed in some of the country's smartest new hotels and motels, this Honeywell Hotel/Motel Master means labor savings and extra convenience for the hotel operator—better service for his guests. Incoming information signals and outgoing command signals provide efficient front desk supervision over maid service and guest room status. And in each installation this new system has proved that electrical signals are cheaper and faster than footsteps.

A Honeywell specialist will be glad to discuss, these new system techniques for hospitals, schools and a wide variety of other applications.

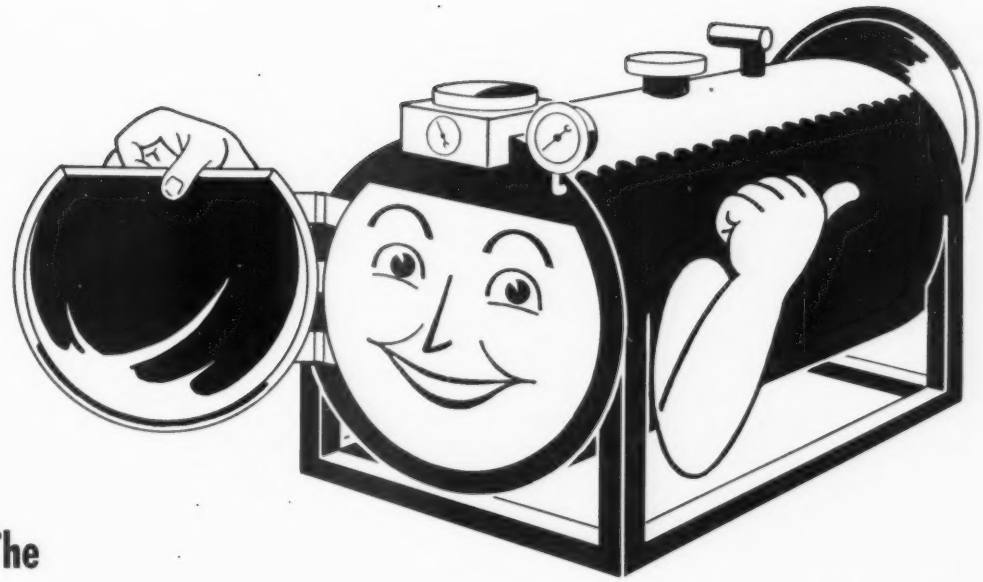
Honeywell offers the owner a contract for complete maintenance on a low-cost annual basis, backing up your service and ours. For further information, call your nearest Honeywell office. * T. M.

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From one console, a desk clerk can read instantly the status of each room; vacant, occupied, being made-up, ready for occupancy. He can signal a maid, inform a guest a message is waiting, adjust lights, TV, air conditioning as guests arrive and depart. A light warns him if a fire starts, gives its location. These and other functions—up to 24—are performed automatically with the Hotel/Motel Master.



The Boiler that doesn't show its age

The practical, two-pass design of the Continental Automatic Boiler is a long-life feature that cuts operation and maintenance cost. The hinged doors – front and back – open on the burner. No baffles or partitions that can be damaged in routine servicing. No take-out, put-back refractories.

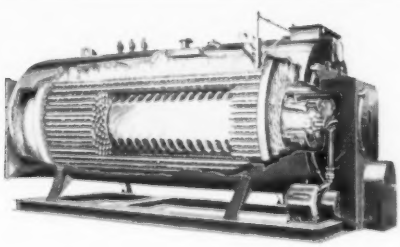
Continental's exclusive "spinning gas" technique heats all return tubes fully and evenly in just two passes, assuring longer service life. Free, rapid water circulation improves heat transfer and keeps heating surfaces clean.

Low maintenance is just one of the cost-saving features of the Continental Automatic Boiler. Every Continental is fire-tested and guaranteed for better than 80% efficiency. Owners report fuel savings up to 33% . . . and Continental efficiency stays constant over a wide load range and a long service life.

Continental Boiler Service, available from coast to coast, includes aid and supervision in start-up, operating instruction for attendants, competent and dependable service when needed. See your service-minded Continental Boiler representative or write for Bulletin BE-3.

BOILER ENGINEERING & SUPPLY COMPANY, INC.
1 Manavon Street, Phoenixville, Pa.

The Continental AUTOMATIC BOILER



Cut-away view of typical Series A Continental Automatic Boiler, firing oil and/or gas. Other models from 20 to 500 hp, with on-off, low-high-low or modulating controls. For steam heating or process work at pressures from 15 to 250 pounds, or for hot water heating at low or high temperatures.

A HALF CENTURY OF BOILER MANUFACTURING EXPERIENCE



Men in Engineering

A. E. Onderdonk, Consulting Engineer, and R. P. Lathrop, Associate, have moved their offices to the Federal Savings Building, 2512 Main St., Glastonbury, Conn. The firm's new telephone number is MEdford 3-9409.

Brender and Brender, Engineers, announce the availability of a Royal Precision LGP-30 Electronic Digital Computer as part of their services. Architects and engineers with problems such as machine time, programming, data preparation and processing, and instruction may obtain information from the firm which is located at 35449 Annapolis St., Wayne, Mich.

Smith, Hinchman & Grylls Associates, Inc., Architects and Engineers, of Detroit, Mich., have moved to new and larger quarters at 3107 West Grand Boulevard.

Maurice H. Connell and Associates, a Miami engineering firm, has added a new $50,000 wing to its Miami headquarters. The new wing houses the bridge and highway departments and will provide working space for 30 or more specialists in this field. Walter Murray heads the bridge department and Harvey Bestwick is in charge of the highway department.

W. E. Fenner, P.E., has opened an office for the practice of consulting mechanical engineering at 1629 Glenwood Ave., Raleigh, N.C. Prior to opening his own office, Mr. Fenner was associated with Zumwalt and Vinther, Dallas, Texas, and L. E. Wooten Co., Raleigh, N.C.

The following engineers have become members of Jones, Henry & Williams, Consulting Engineers, of Toledo, Ohio: Harry E. Heck, Ellis M. Keeler, Harold A. Kelley, Coburn C. Metcalf, Cecil B. Russell, and Roger W. Stevens.

New executive officers of The Austin Co., Engineers and Builders, of Cleveland, Ohio, have been elected as follows: George A. Bryant, former president and general manager, chairman and chief executive officer; Allan S. Austin, president; Harold A. Anderson, chief executive vice president and general manager; and H. A. Hallstein, vice chairman.

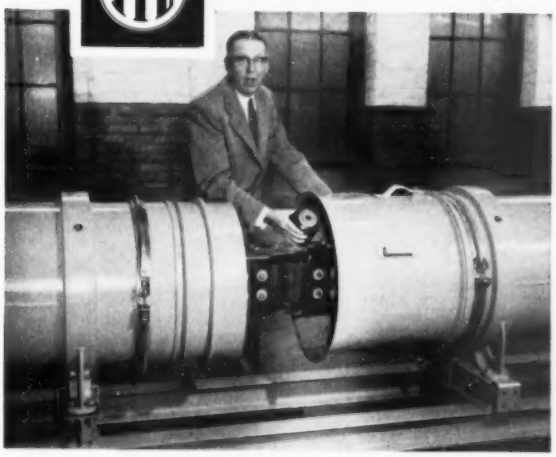
The American Society of Civil Engineers, at its Annual Banquet in Chicago, last month presented 10 of its members with Life Membership certificates. They are: John E. Bernhardt, Wm. J. Howard, Inc.; Lawrence L. Edlund, Armour & Co.; Alvah S. Holway, Master Builders Co.; Charles H. Mottier, Illinois Central Railroad;

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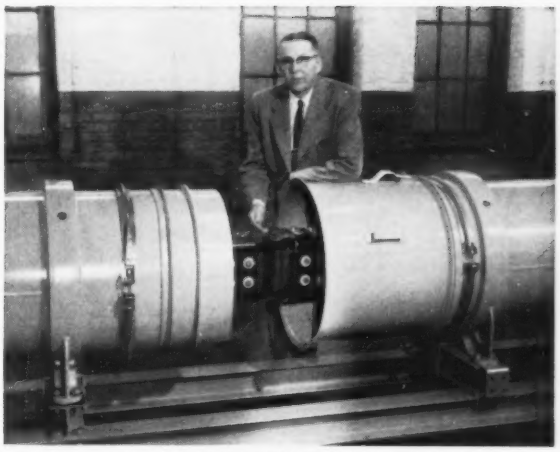


NEW WING FOR MAURICE H. CONNELL AND ASSOCIATES, MIAMI

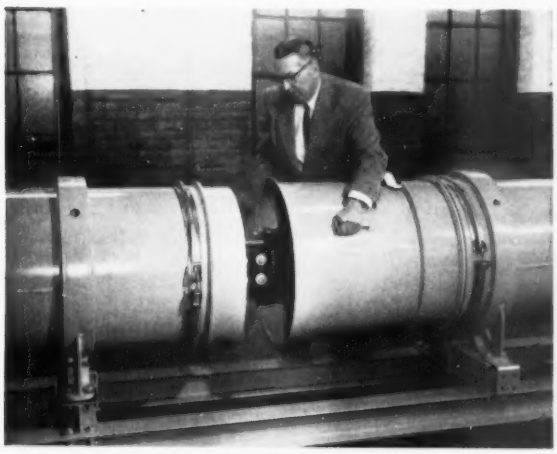
ISOLATED PHASE BUS



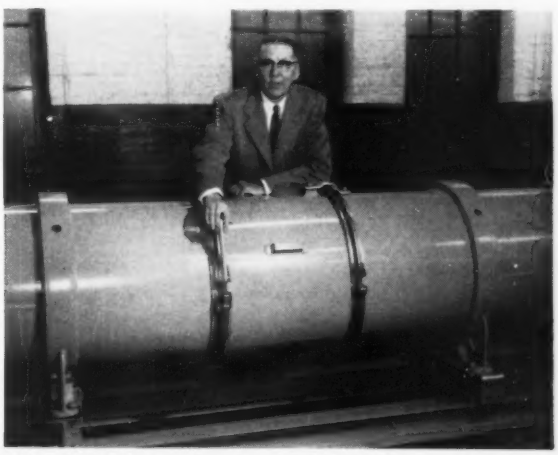
Sliding cover in open position. Connectors are easily accessible for assembly and maintenance. High-strength wet porcelain insulators, mounted in compression, are easily reached for inspection and removal.



Connectors can be either bolted or field welded. When bolted, Belleville washers are used to maintain adequate contact pressure. Conductors are either copper or aluminum. All copper connections are silver plated.



Sliding cover in partially closed position. Flanged cover, flanged rings, lifetime silicone rubber gaskets and clamping bands provide a positive seal, prevent dust accumulation, simplify opening and closing.



Sliding cover in closed position. Closure requires only two 1-piece lifetime silicone rubber gaskets—easy to place and remove. Simple, powerful V-clamp band exerts pressure uniformly around the flanged rings.

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I-T-E Isolated Phase Bus is available in ratings through 138 kv, through 20,000 amp. Self and forced-air cooled. Send today for Bulletins 10004-A and 10004-B, giving complete information. I-T-E Circuit Breaker Company, Switchgear Division, 19th & Hamilton Sts., Philadelphia 30, Pa. In Canada: Eastern Power Devices Ltd., Toronto, Ontario.

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PHILADELPHIA, PENNSYLVANIA

HOW TO GET AROUND TIME and COST FACTORS

in Protecting Pipe Against Corrosion

When you are faced with the problem of protecting piping underground in highly corrosive soils, a high quality coal tar coating such as called for in AWWA Specifications C-203 and C-204 is normally hot applied at a pipe coating mill. However, in many cases, the volume of pipe does not warrant this expense or the coating mill is too far away to justify the time involved.

That's WHEN Engineers Specify TAPECOAT . . . the practical alternate hot-applied coal tar coating in handy tape form

Because TAPECOAT provides a coal tar coating equivalent in long-life protection to hot-applied coating at the mill, engineers are specifying this quality alternate material where time and cost factors preclude mill application.

This practical solution assures the protection required without the need for tar kettles, technical know-how and special crews. Field application costs are reduced because TAPECOAT is so easy to apply, using a torch to soften or bleed the pitch and then spirally wrapping it on the vulnerable surface.

TAPECOAT comes in handy rolls of 2″, 3″, 4″, 6″, 18″ and 24″ widths. Since 1941, it has proved its ability to give lasting protection to pipe, pipe joints, couplings, conduit, cable and insulated piping.



Write for illustrated brochure.

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Originators of Coal Tar Coating in Tape Form

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Henry Penn, consulting engineer; Ivan C. Peterson; Charles S. Pillsbury, Chicago Bridge & Iron Co.; Clarence A. Walkwitz, Shaw, Metz and Dolio; Ernest G. Waters, consulting engineer; and Thomas F. Wolfe, Cast Iron Pipe Research Association.

George M. Callen, Jr., Consulting Engineer, has moved to new offices at 2130 Highland Ave., Birmingham, Ala.

A new partnership, Bouillon, Griffith & Christofferson, has been formed to take over all of the activities of the previous partnership of Bouillon and Griffith. Principals of the firm are: Lincoln Bouillon, Herbert T. Griffith, L. F. Christofferson, and Robert H. Schairer. The new firm will continue to be located in the 1411 Fourth Avenue Building, Seattle, Washington.

L. R. Glosten, Naval Architect & Marine Engineer, has opened offices at 71 Columbia St., Seattle, Wash. Mr. Glosten formerly was a partner in the firm of Philip F. Spaulding and Associates.

Holladay & Westcott, Engineers, of Los Angeles, Calif., have moved their office to 800 West Colorado Boulevard. New telephone number is CLinton 5-1565.

The consulting engineering office of O. W. Motz and Associates now is located at 2516 Park Ave., Cincinnati 6, Ohio. Telephone number is WOodburn 1-1152.

James H. Howard has reorganized his consulting engineering firm to a corporation. Officers of the new corporation are as follows: James H. Howard, President; E. Bruce Appling, vice president-treasurer; and Kenneth E. Brown, vice president-secretary. Associates of the firm are: Robert L. Anderson, Robert C. Howell, Gino E. Bisone, George Blount, George F. Brown, E. W. Fredell, Robert Frias, Marion M. Griffin, Achilles Kozakis, and J. Blake Shipp. Offices are at 2728 Weslayan St., Houston, Texas.

Ebasco also announces the appointments of E. C. Yaw as chief mechanical design engineer, Samuel B. Smith as consulting electrical engineer, and F. A. Ritchings as assistant consulting mechanical engineer.



PIERCE SMITH

Robert E. Pierce has been appointed chief consulting engineer of Ebasco Services Incorporated, of New York City. Mr. Pierce succeeds Howard L. Melvin who continues with the company as a general engineering consultant.



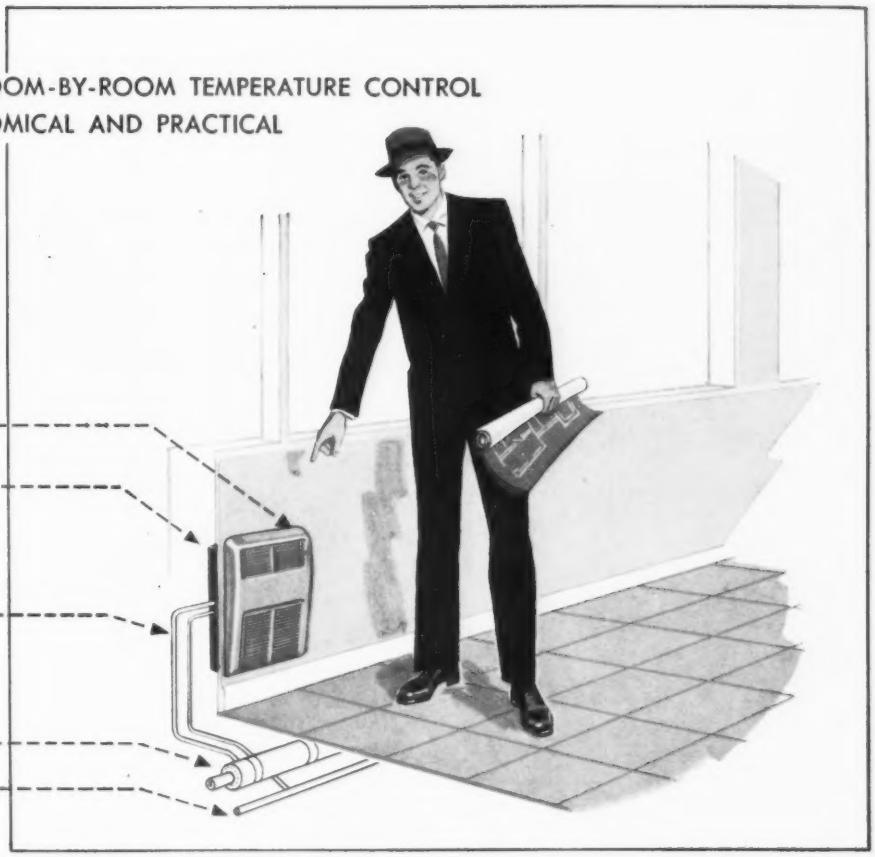
MacKRELL MELVIN

Franklin C. MacKrell, vice president and district manager of the Chicago office of Stone & Webster Engineering Corp., New York City, has been elected a director of the firm. Mr. MacKrell is a member of the Association of Management Engineers and a member of the Executive Council of the American Society of Naval Engineers.

Announcement also has been made by Stone & Webster of the promotion of three engineers. Theodore E. Casselman, Jr., has

ACCURATE ROOM-BY-ROOM TEMPERATURE CONTROL
NOW ECONOMICAL AND PRACTICAL

IRON FIREMAN SelecTemp® HEATING



New answer to old heating problems

The problem of room temperature control. SelecTemp heating is a new application of steam heat in which heat from a central source (low pressure boiler or district steam) is automatically regulated in each individual room. Temperature control is very accurate.

The problem of balanced heat. The warm and cool sides of a building are uniformly heated. A thermostat in each room automatically regulates heat according to room needs, compensating for any exterior or interior heat loss or gain resulting from wind, sun, fireplace, or a varying number of occupants.

The problem of varied temperatures for varied activities. In a school, for example, SelecTemp meets the different needs of classrooms, gymnasium, library or shop.

The problem of space. SelecTemp uses no floor space; compact room units, only 18" high, are recessed into walls. Steam supply and return lines of small copper tubing are concealed in walls and under floors. Extra space is not required for ducts or rigid pipes, permitting unusual design freedom, and in most cases, savings in construction costs.

The problem of modulated heat. Air circulation is steady. Temperature is controlled by regulating the amount of warmth delivered—not by stop-and-go cycling. Temperature is remarkably uniform from floor to ceiling and from corner to corner.

The problem of economy. With all its advantages, SelecTemp costs no more than many conventional systems not providing this unique automatic temperature control of each room. Fuel is saved because unoccupied rooms can be kept cool and reheated in a few minutes. Occupants do not waste heat through open windows. SelecTemp heating is equally suited for use in both new and existing construction.

SELECTEMP ROOM HEATER SPECIFICATIONS

	Model H-6	Model H-12	Model H-18
Output, Btu/hr at 10 PSI	6,000	12,000	18,000
Wall opening	17"x 6¾"	17"x 11"	17"x 15½"
Air Vol. CFM	60	120	180
Room heater supply line from main	⅜" O.D. Copper Tube		
Room heater return line to main	¼" O.D. Copper Tube		
Thermostat Range	40° to 90°		

See catalog in Sweet's Architectural and Light Construction Files

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Engineered HEATING AND COOLING

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☐ Send SelecTemp specifications and full information.
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4201 Belmont Ave., Chicago 41, Ill.

been named an assistant engineering manager, Normal L. Foskett, chief process engineer since 1952, has been appointed chief engineer of the chemical division, and Stanley B. Zdonik named chief process engineer succeeding Mr. Foskett.

Karl G. Frese, Jr. has been appointed assistant branch manager of the St. Petersburg office of Rader and Associates, engineers and architects, of Miami, Fla. Mr. Frese will assist Edward R. Lampp and his staff.

Charles W. Lerch & Associates, elevator consulting engineers, have moved to larger quarters in the Board of Trade Building, Chicago, Ill. The firm also has offices in Denver and San Francisco.

The Helin Engineering Co. has moved its offices to 800 W. Colorado Blvd., Los Angeles 41, Calif. The new telephone number is Clinton 5-5103.

Dudley Deane, of Dudley Deane and Associates, consulting engineers, of San Francisco, Calif., has been elected vice chairman of the Building Industry Conference Board, San Francisco, Calif. Wendell R. Spackman, architect and partner in the firm of Corlett and Spackman, was elected chairman.

The structural engineering organization of Harold B. Husted, Consulting Engineer, has moved into new enlarged offices at 4326 Market St., Youngstown 12, Ohio.

Five key executives have been promoted by Holmes & Narver, Inc., Los Angeles engineers and constructors. The basic organizational change involves separating the firm's engineering and construction responsibilities. Thomas W. Burtt, formerly vice president in charge of the combined activity is now vice chairman of the board. David L. Narver, Jr., formerly Burtt's assistant, has stepped up to vice president, engineering.

In charge of the newly formed construction division is D. C. Van Dine, former manager of engineering and construction. Van Dine is now vice president, construction.

Charles B. Roen, previously manager of the petrochemical division, is now vice president, and Maynard R. Born, assistant manager under Roen, was appointed assistant vice president, petrochemical division.

William S. Pollard, Jr., chief engineer, has become a full partner in the firm of Harland Bartholomew and Associates, of St. Louis, Mo. Also elevated to partnership is Donald Wolbrink, resident planner of the organization's Honolulu office. Previously both new partners were associates in the firm.



WOLBRINK



POLLARD

Johannssen & Girand, Consulting Engineers, Phoenix, Arizona, has announced the election to firm partnership of Frank W. Bromley, William N. Woodruff, and Robert L. Norton.

The partnership of Rebmann & Gay, Consulting Engineers, St. Louis, has been expanded into the partnership of Rebmann Gay Herold, Consulting Engineers. The same location at 1502 St. Louis Avenue is maintained.

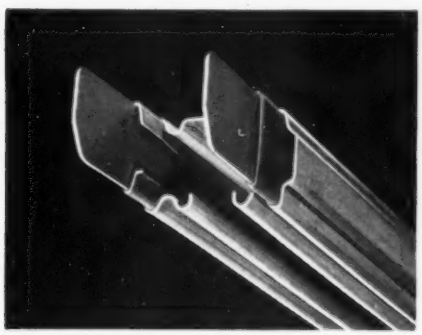
Appointment of Ralph R. Taggs to the position of Assistant Editor on the staff of the Technical Publications Department of the 39,000 member American Society of Tool Engineers has been announced. Mr. Taggs has been associated in the past with Albert Kahn, Associated Architects and Engineers, Inc., Detroit. ▲▲

New Universal Lighting System—

for flexible, low-cost lighting

Specify efficiency and economy, too. BullDog's new 20-amp Universal Lighting System both feeds and supports lighting fixtures . . . requires no supplementary fusing. Fixtures can be positioned at any spot throughout the entire system . . . are quickly and easily moved to meet changes in lighting requirements. No rewiring or electrical downtime, either.

Listed by Underwriters' Laboratories, this new Universal Lighting System assures maximum flexibility at minimum cost. Check its many advantages. Consult your electrical distributor or BullDog field engineer. Or write BullDog Electric Products Co., Detroit 32, Michigan. © BEPCO



CROSS SECTION of new, low-cost 20-amp Universal Lighting System. Movable weight supports and twistout plugs speed rearrangement, addition or removal of fixtures, eliminate rewiring and electrical downtime.



BULLDOG

BullDog Electric Products Co., Detroit 32, Mich. A Division of I-T-E Circuit Breaker Co.
BullDog Export Division: 13 East 40th St., New York 16, N.Y.
In Canada: BullDog Electric Products Co. (Canada) Ltd., 80 Clayson Rd., Toronto 15, Ont.

New Projects Reported

By Consulting Engineers—

ALABAMA

Michael Baker, Jr., Inc.
Jackson, Mississippi.
Design of 25 miles of interstate highway system and mapping of 13 miles of terrain for alternate route study in Etowah and Dekalb Counties, Ala. (civil) $11,250,000. Client, State of Alabama Highway Department.

Keller Weaver
Birmingham, Alabama.
Water, sewer, and gas systems. (civil) $250,000. Client, City of Odenville.

Shopping center, Birmingham, Ala. (struc., mech., elec.) $150,000. Client, Owens Realty Co.

Post office, Trussville, Ala. (struc., mech.) $20,000. Client, S. A. Liles.

Shopping center, Homewood, Ala. (struc., mech., elec.) $250,000. Client, Irving Porter & Nelson Weaver Co.'s.



more than 300 sound system experts

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CORPORATION
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Please send me full information on DuKane sound systems. I am especially interested in

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☐ churches ☐ _____

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Firm _____
Address _____
City & State _____

ARIZONA

John A. Carollo, Consulting Engineers
Phoenix, Arizona.
Waterworks improvements including sedimentation basin, pumping station, filter plant, water treatment plant, 20 mgd reservoir. (civil) $5,000,000. Client, City of Phoenix, Ariz.

CALIFORNIA

George F. Nicholson, Consulting Engineer
Long Beach, California.
Marina Del Rey, Los Angeles County, pleasure boat harbor. $40 million.

Port of Sacramento, harbor and 45-mile ship channel. $38 million. Long Beach Alamitos Bay marina. Joint venture with **Moffatt & Nichol** and **J. W. B. Blackman,** Consulting Engineers of Long Beach. $14 million.

Port of San Luis commercial and pleasure boat harbor, San Luis Obispo County. $8.5 million.

Santa Monica breakwaters and marina. $7 million.

Long Beach Ninth Street bridge. Joint venture with **Moffatt & Nichol,** Consulting Engineers of Long Beach. $8.2 million.

Long Beach, U.S. Navy permanent boat basin and landings. $3 million.

Long Beach-Anaheim bridge, joint venture with **Moffatt & Nichol,** Consulting Engineers of Long Beach. $3 million.

Ira S. Kessey
Oakland, California.
Factory building, Millsdale Industrial Park, Burlingame, Calif. 9000 sq ft, steel frame, masonry exterior, office and patio attached. (civil, struc., mech., elec.) $80,000. Client, Cratex Mfg. Co.

Recreation building, San Leandro, Calif. 30,000 sq ft, steel frame, masonry exterior, gymnasium, natatorium, and club rooms. (struc.) $400,000. Client, San Leandro Boy's Club.

Recreation building, Oakland, Calif. 6000 sq ft, beam and girder suspended by cables from steel A-frame on steep hill. (struc.) $100,000. Client, City of Oakland Park Department.

Country club building, 25,000 sq ft, glue-laminated frame, Menlo Park, Calif. $350,000. Client, Arrowhead Country Club.

Stoddard & Karrer
Los Banos, California.
Irrigation distribution system for irrigation of 70,000 acres. (civil). $12,302,000. Client, Solano Irrigation District, Suisun, Calif.

James A. Tuck
Ft. Pierce, Florida
105-room, 8-story hotel. Roof garden, swimming pool, 60 cabanas, each 9-x 10-ft. Cocoa Beach, Fla. $1,200,000. Client, T. Doherty.

110-room, 8-story hotel. Swimming pool, 65 cabanas, Eau Gallie, Fla. $1,450,000. Client, Hotel Enterprises, Incorporated.

Shopping center, Ft. Pierce, Fla. 175,000 sq ft. $1,500,000. Client, Enterprises, Inc.

COLORADO

Henningson-Durham & Richardson
Colorado Springs, Colorado.
Paving for City of Durango, Colo. (civil) $1 million. Client, City of Durango.

Water treatment report. (civil) $30,000. Client, Town of Dolores, Colo.

Report on secondary sewage treatment. (civil) $40,000. Client, Town of Rifle, Colo.

New boiler installation. (struc., mech.) $7500. Client, City of Colorado Springs, Colo.

IB Falk Jorgensen, Consulting Engineer
Denver, Colorado.
The Young Towers apartment buildings (15 stories), Denver, Colo. $3.5 million. Client, Carl Groos, O'Neil Ford & A. B. Swank, Architects.

CONNECTICUT

Hajian-Malkasian Associates
Boston, Massachusetts.
Stop & Shop Supermarket, Hamden, Conn. (struc., arch.) $250,000. Client, Stop & Shop, Inc.

Fred S. Dubin Associates
Hartford, Connecticut.
High school, West Hartford, Conn. (mech., elec.) $4 million. Client, Warren Ashley, Arch.

Memorial Hospital, New Britain, Conn. (civil, mech., elec.) $1,700-000. Client, Henry Ludorf, Arch.

Robert S. Loomis, Engineers
Windsor, Connecticut.
St. Anthony School addition, Bristol, Conn. (struc.) $200,000. Client,

Here's Why...

Silicone Insulated Drive Motors Give Reliability At Lowest Cost

When reliability is a must . . . when essential auxiliaries have to keep going twenty-four hours a day, year in and year out despite temporary overloads and high ambients . . . that's when it pays to have drive motors that are insulated with heat-stable Dow Corning Silicones.

Utility engineers report that silicone insulated auxiliary drive motors carry 30% to 50% overloads without "strain or pain". That's because the thermal stability of Dow Corning Silicones means greater service factor than is possible with any other insulation.

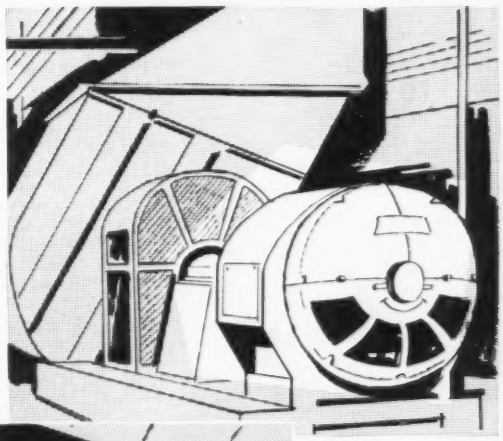
And silicone insulated motors operate at lowest cost because motor horsepower can be matched to normal load. When operating at full load efficiency, there's still plenty of reserve for overloads. You save money on power costs and maintenance, too.

What's more, silicone-insulated motors survive other power plant hazards, such as water, steam, dust, fly ash, cinders and similar motor-killing contaminants.

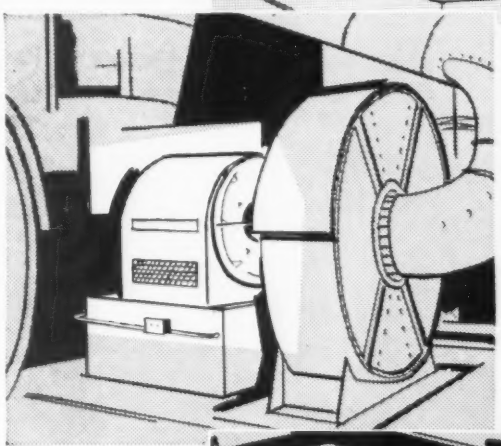
Most leading manufacturers now offer silicone-insulated motors in a wide range of sizes for power plant service. **Reliability costs less with silicones.** That's why it always pays to . . .

Specify DOW CORNING SILICONES and *Save*

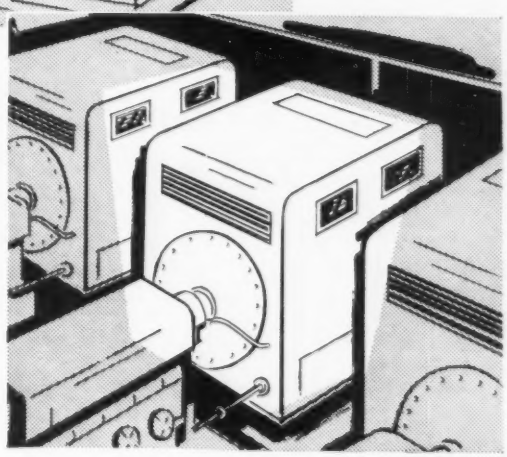
Write Dept. 103 for list of builders who offer Dow Corning silicone-insulated motors.



High ambients and temporary overloads are taken in stride by silicone insulated induced draft fan motors



Coal pulverizers and other essential auxiliaries operate more efficiently with silicone insulated motors matched to normal load



Self-protecting silicone rubber insulation in these boiler feed pump motors defies heat and moisture

first in silicones

Dow Corning CORPORATION

MIDLAND, MICHIGAN

ATLANTA • BOSTON • CHICAGO • CLEVELAND • DALLAS
DETROIT • LOS ANGELES • NEW YORK • WASHINGTON, D. C.

Rossetti, DiCorcia & Mileto, Arch.

Windsor Junior High School, Windsor, Conn. (struc.) $1,500,000. Client, Louis Drakos, Arch.

Pleasant Valley School, So. Windsor, Conn. (struc.) $450,000. Client, Kane & Fairchild, Arch.

South West Junior High School, New Britain, Conn. (struc.) $1.8 million. Client, W. Wilkins, Arch.

FLORIDA

Haas, Register, Cummings & Hutchinson
Jacksonville, Florida.
Master Plan, City of Macclenny, Fla. Client, City of Macclenny, Fla.

Utilities extensions including sewerage and water plants, collection system, water treatment and distribution, paving and drainage. $2 million. Client, City of Macclenny, Fla.

Jas. Gamble Rogers, Lovelock & Fritz
Winter Park, Florida.
Plant disease laboratory. (arch., struc., mech., elec.) $570,000. Client, University of Florida, Gainsville.

Orange County courthouse annex. (arch., struc., mech., elec.) $3,500,000. Client, Orange County, Fla.

Nuclear research laboratory. (arch., struc., mech., elec.) $750,000. Client, Florida State Univ., Tallahassee, Fla.

V. D. Gosselin,
Ocala, Florida.
Aggregate recirculation system. $10,000. Client, Universal Concrete Pipe Co., Div. of American Marietta Co.

IDAHO

Cornell, Howland, Hays & Merryfield
Corvallis, Oregon.
Design primary treatment plant and interceptor sewer. $1,600,000. Client, City of Idaho Falls, Idaho.

IOWA

Frank L. Pulley, Consulting Engineer
Des Moines, Iowa.
Lynnville-Sully High School, Sully, Iowa, (mech., elec.) $500,000. Client, N. Clifford Prall, Arch., Des Moines, Iowa.

Grace Methodist Church addition, Spencer, Iowa. (mech., elec.) $300,000. Client, William Beuttler, Arch. Sioux City, Iowa.

Wartburg College library, Waverly, Iowa. (mech., elec.) $250,000. Client, Woodburn & O'Neil, Arch., Des Moines, Iowa.

Child guidance center addition to Blank Memorial Hospital, Des Moines. (mech., elec.) $200,000. Client, Wetherell & Harrison, Arch., Des Moines, Iowa.

Craig T. Wright School, Des Moines. (mech., elec.) $250,000. Client, Wetherell & Harrison, Arch., Des Moines, Iowa.

LOUISIANA

J. J. Krebs & Sons
New Orleans, Louisiana.
80-unit motel, New Orleans. (civil, struc., elec.) $350,000. Client, W. P. Bosworth, Jr.

First section of subdivision, St. Bernard Parish, La. (civil) $400,000. Client, Carolyn Park, Inc.

Fred Kull, Consulting Engineer
Monroe, Louisiana.
First National Bank of West Monroe, La. 2-story, masonry and steel frame. (mech.) $200,000. Client, Beuford Jacka, Arch., West Monroe, La.

Ruston housing projects, Ruston, La. (mech.) $938,000. Client, Milton King, Arch., Monroe, La.

MARYLAND

Ewell, Nelson & Bomhardt
Baltimore, Maryland.
65-ft prestressed concrete beam bridge over Deep Creek, Hanover. (civil, struc.) $48,000. Client, Department of Public Works, Anne Arundel County and Howard County, Maryland.

Barclay Elementary School, Baltimore, Md. (struc.) $1,125,000. Client, Cyril H. Hebrank, Arch.

Edgewood Elementary School, Baltimore, Md. (struc.) $1 million. Client, Cochran, Stephenson & Wing, Architects.

92-ft prestressed concrete beam bridge over Gwynns Falls, Baltimore, Md. (civil, struc.) $225,000. Client, Department of Public Works, Baltimore, Md.

Oriole cafeteria building, Baltimore, Md. (struc.) $334,000. Client, Francis J. Thuman, Arch.

Gymnasium building, Coppins State Teachers College, Baltimore, Md. (struc.) $500,000. Client, Francis J. Thuman, Arch.

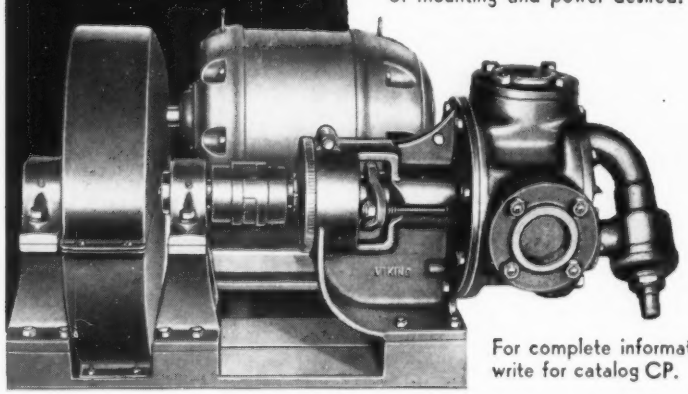
Edmondson Avenue office building, Baltimore, Md. (struc.) $250,000. Client, Weber & Jacobs, Arch.

Johnson & Williams
Washington, D.C.
Water and sewerage, Waldorf, Md.

for **RUGGED PUMPING**
Specify **VIKING** Heavy Duty **PUMPS**

When jobs require rugged pumping, you can depend upon Viking Pumps. All are fast self-priming and positive in action. Models are built to handle liquids ranging from LP-Gas up to those of a viscosity of 2,500,000 SSU.

Choose yours in sizes of 10, 20, 35, 50, 90, 150, 200, 300, 450, 750 and 1050 G.P.M. Suitable for pressures to 200 psi on lubricating liquids, or 100 psi on non-lubricating liquids. Built of many types of metals and combinations of metals. Available in any type of mounting and power desired.



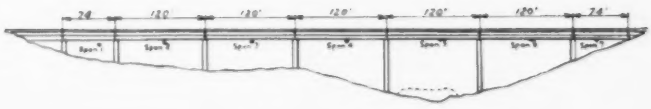
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PLASTIMENT CONCRETE Ddensifier

Specified FOR PHILADELPHIA'S GORGAS LANE BRIDGE





Plastiment concrete in 7 foot deep beams is being revibrated before deck is placed.

This unusual monolithic prestressed beam and slab design resulted from alternate bids permitted by Philadelphia's progressive Department of Streets* . . . Savings of more than 20% over conventional steel design were passed on to the taxpayers.

Each 120 ft. long span, 34 ft. wide; including two traffic lanes, sidewalk, and half of the center median strip was concreted in one continuous 260-yard operation . . . Since 8-10 hours elapsed during placement, Plastiment was specified to control initial set. Plastiment provided these additional benefits: better compaction, greater density, and faster development of stressing strength.

Your clients will benefit from the better structural quality of Plastiment concrete . . . Specify Plastiment for your next job . . . Write for Bulletin PCD.

AD 26-7

*David M. Smallwood, Street Commissioner
Noel W. Willis, Chief Bridge Engineer

The Preload Company, Inc., New York City—Consulting Engineers
The Conduit & Foundation Corporation, Philadelphia—Contractor

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For storage and handling of industrial wastes and chemicals.



575,000 gallon capacity, 3" Fir Wood Tank. 70 ft. diameter inside x 20 ft. stave with sloping bottom downtake, laminated launder, baffle walls and take off boxes. Erected — Celanese Corp. of America, Amcelle, Md.



Wendnagel 100M Gallon Wood Tank and 125 ft. Steel Tower for Domestic Water Supply.

Send for new bulletin on use of Wood Tanks for chemicals.

Wendnagel & Co., Inc.

610 W. Cermak Road
Chicago 16, Ill.

$500,000. Client, Charles County, Sanitary District, Inc.

Fred S. Dubin Associates
Hartford, Connecticut.
Chestnut Hill Lodge Hospital, Rockville, Md. (mech., elec.) $800,000. Client, Satterlee & Smith, Arch.

MASSACHUSETTS

Fred S. Dubin Associates
Hartford, Connecticut.
Preliminary plans, Harvard University medical infirmary and clinics. (mech., elec.) $12 million. Client, Jose Sert, Arch.

High school, Concord, Mass. (mech., elec.) $2,500,000. Client, Warren Ashley, Arch.

Regional high school, Charlemont, Mass. (mech., elec.) $2,800,000. Client, Warren Ashley, Arch.

Senior High school, Weston, Mass. (mech., elec.) $2 million. Client, Hugh Stubbins, Arch.

MICHIGAN

Stuart D. Long
Grand Rapids, Michigan.
Three-story, air conditioned office building, consisting of 55 suites for physicians, dentists, and allied services. Pharmacy, laboratory, and X-ray unit included. Flint, Mich. $750,000. Client, Brice McMillen, Arch.

Mens dormitory building, Central Michigan College, Mt. Pleasant, Mich. 4-story, 74 individual 2-room suites with lounge and recreation room, to house 296 students. $1,200,000. Client, Roger Allen & Assoc., Architects.

Four-story dormitory building, Ferris Institute, Big Rapids, Mich., consisting of 66 suites, housing 264 students, recreation room, lounge and lobby, and two guest suites. $1 million. Client, Roger Allen & Assoc., Architects.

MINNESOTA

Lindsey Carter & Associates
Excelsior, Minnesota.
and
Robert E. Erickson Engineering Co.
St. Louis Park, Minnesota.
Trunk highway No. 280, ¾ miles of expressway. (civil, struc.) Client, Minnesota Department of Highways.

MISSISSIPPI

Hamilton-Shultz-Luke
Meridian, Mississippi.
Sewerage disposal plant and additions to sewerage disposal system. $2 million. Client, City of Meridian, Mississippi.

Additions to water distribution system and water treatment plant. $1,500,000. Client, City of Meridian, Mississippi.

NEBRASKA

Dwyer & Kite
Kansas City, Missouri.
Additions to feed mill and warehouse facilities, Omaha, Neb. (civil, struc., mech., elec.) $150,000 (est.). Client, Standard Chemical Mfg. Co.

NEW HAMPSHIRE

Fred S. Dubin Associates
Hartford, Connecticut.
Six dormitories, Dartmouth College, New Hampshire. (mech., elec.) $3 million. Client, Campbell & Aldrich.

NEW JERSEY

Arthur H. Bronk, Consulting Engineer
Little Falls, New Jersey.
Lutheran Welfare Association Old Folks Home, Jersey City, N.J. (mech., elec.) $400,000. Client, Solstad & Meyer, Arch., Passaic, N.J.

Engineers, Incorporated
Newark, New Jersey.
One-story, air conditioned office building, 18,000 sq ft with hung ceiling, under-floor ducts for electricity and telephone, partitions, service facilities for 120 employees. Brick on block back-up. (civil, struc., mech., elec.) $246,000. Client, Leslie Co., Lyndhurst, N.J.

Fred S. Dubin Associates
Hartford, Connecticut.
Jewish community center, Trenton, N.J. (mech., elec.) $800,000. Client, Louis Kahn, Arch.

Harrison A. Martin, P.E.
New York, New York.
Atlantic Superama shopping center, Eatontown, N.J. (civil, struc., elec.) $450,000. Client, Murry Conners, owner.

Single-story building, 30,000 sq ft, concrete, steel, masonry, and wood. Third section of store, Eatontown, N.J. (civil, struc.) $200,000. Client, Atlantic Superama, Inc.

Runyon & Carey Associates
Newark, New Jersey.
North Junior High School, Bloomfield, N.J. (mech., elec.) $2,950,000 (total). Client, Micklewright & Mountford, Arch.

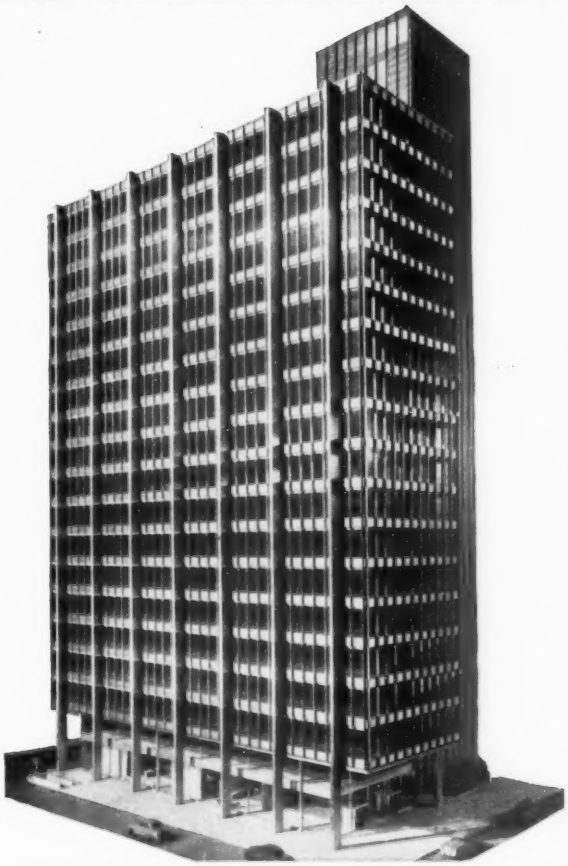
New elementary school, Paramus, N.J. (mech., elec.) $1,250,000 (total). Client, Licht & Johnson, Arch.

Daughters of Israel Home, West Orange, N.J. (mech., elec.) $2 mil

Weldynamics



ARC WELDING AT WORK CUTTING COSTS

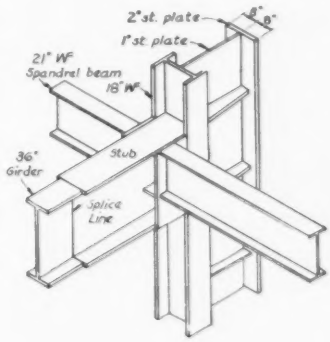


Weldynamics paves the way for new and better design

Creative ingenuity, made practical by Weldynamics, came forth with this 19 story building with a column free interior. All floors are suspended between 14 exterior columns. Thus the architect was able to provide more floor space free from obstruction.

The exterior columns are shop fabricated with automatic Lincolnweld submerged arc welding. Down-hand field welding is accomplished with Lincoln Jetweld LH-70, iron powder low-hydrogen electrodes for welding speed and economy.

The Inland Steel Company Building, Chicago, Illinois. Erected by John B. Beasley Construction Company; shop fabrication by Joseph T. Ryerson & Son, Inc.; General Contractor, Turner Construction Company; Architects, Skidmore, Owings and Merrill.



Typical column to which a stub support, part of a torque box, is welded.

ARCHITECTS! ENGINEERS! PUT WELDYNAMICS TO WORK ON YOUR STRUCTURES

Lincoln provides the aids to help you with your projects: "Procedure Handbook of Arc Welding Design and Practice". 1300 pages fully illustrated includes 466 pages devoted to Structural Design. $3.00 postpaid in U.S.A., $3.50 elsewhere. "Studies in Structural Arc Welding" sent free to architects and structural engineers. Write us!

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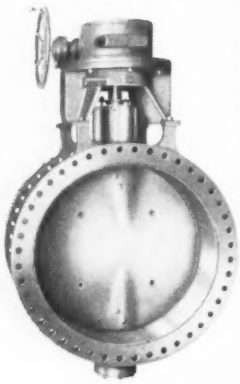


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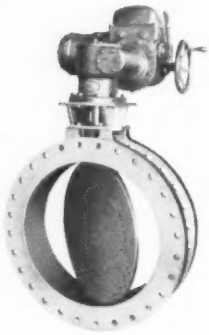
THE LINCOLN ELECTRIC COMPANY, DEPT. 5808, CLEVELAND 17, OHIO

ROCKWELL VALVES

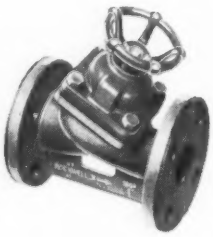
for your power, water and process piping projects



Standard butterfly valve (American Water Works Assn. specifications) with gum rubber seat inset in valve body for drop-tight shut-off of water; may be furnished with manual gear operator or with electric motor or cylinder operator.



Standard heavy duty butterfly valve with Limitorque electric motor, declutching mechanism and handwheel for air, gases, water or other fluids.



"D-D" diaphragm valve for corrosive or abrasive fluids, vacuum or other service; diaphragm for positive sealing and disc for positive closure; no packing gland to leak; high capacity, low pressure drop; easy to operate.

There's a Rockwell standard or special valve for practically every fluid service indicated in your plans. Get our catalog.

W. S. ROCKWELL COMPANY
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FAIRFIELD, CONN.

lion (total). Client, Kelly & Gruzen, Architects.

Smith and Hacker
Orange, New Jersey.
Two-story department store and service building. Precast concrete including precast retaining walls. (struc.) $1 million. Client, W. E. Lehman, Arch., Newark, N.J.

NEW YORK

Emil Gruenberg & Associates
New York, New York.
Animal husbandry building, Cornell University, Ithaca, N. Y. (mech., elec.) $4 million (est.) Client, James C. Mackenzie, Arch. and New York State Department of Public Works.

Gruenwald Associates
Long Island City, New York.
New steam generating plant for one boiler with accommodations for second boiler, Brooklyn, N.Y. (struc., mech., elec.) $150,000. Client, Reliable Knit Processing Co., Inc.

Henry J. Campbell, Jr., P.E.
Mineola, New York.
Redstone shopping park, Malverne supermarket, and miscellaneous specialty stores. (elec.) $500,000. Client, Henry B. Raymore, Arch., Howard J. Teas, P. E.

Huntington Public Library additions and alterations to modernize building. (mech., elec.) $100,000. Client, Harold J. Greene, Architect.

Terryville School, Port Jefferson, alteration to existing building and addition of 8 classrooms, cafeteria and gymnasium. (mech., elec.) $450,000. Client, Charles A. Wood, Arch.

Fred S. Dubin Associates
Hartford, Connecticut.
High school and junior college, Corning, N.Y. (civil, mech., elec.) $10 million. Client, Caudill, Rowlett & Scott, Arch.

Gramatan National Bank, Manhattenville, N.Y. (mech., elec.) $1 million. Client, Fred Frost Assoc., Arch.

Museum of Modern Art, New York. New air conditioning. (mech., elec.) $500,000. Client, Museum of Modern Art.

High school, Mohonasen, N.Y. (mech., elec.) $2,250,000. Client, Warren Ashley, Arch.

Gennaro Mianulli
Brooklyn, New York.
Doctors' hospital alteration, Bayville, L.I. (struc.) $500,000. Client, Michael W. Frudakis, Arch., Brooklyn, New York.

Town library, Glen Cove, L.I. (struc.) $250,000. Client, Michael A. Pascucci, Arch., Glen Cove, Long Island, New York.

Chester Schiff, Electrical Engineer
New York, New York.
Universal Funeral Chapel. Complete electrical alteration of 4-story existing building and new 4-story addition. (elec.) $40,000. Client, Universal Funeral Chapel, Inc.

20,000 sq ft drafting room building, College Point, Queens, N.Y. (elec.) $60,000. Client, Heller and Meltzer, Architects.

Stuart H. Snyder, Consulting Engineer
Syracuse, New York.
Airport terminal building, Oneida County, N.Y. Alterations to existing steel frame building, plus new 2-story reinforced concrete addition. (struc.) $500,000. Client, Edmund J. Booth, Arch., Utica, N.Y.

Fixed-base operators' hangar, Oneida County, N.Y. New concrete framed building with prestressed roof girders and tilt-up concrete walls. (struc.) $120,000. Client, Edmund J. Booth, Arch., Utica, N.Y.

Immaculate Conception School, Fayetteville, N.Y. Steel framed elementary school with classroom wing and auditorium. (struc.) $380,000. Client, Pederson & Hueber, Arch., Syracuse, N.Y.

Otto J. & Warren A. Sambach
Williston Park, New York
Craneway building, 75x350 ft, Kingston, N. Y. (struc.) $200,000. Client, Hudson Cement Co.

Julius Schubert, P.E.
Lindenhurst, New York
Medical Arts Center, Long Island, New York. $350,000. Client, Patsy DiSomma.

NORTH CAROLINA

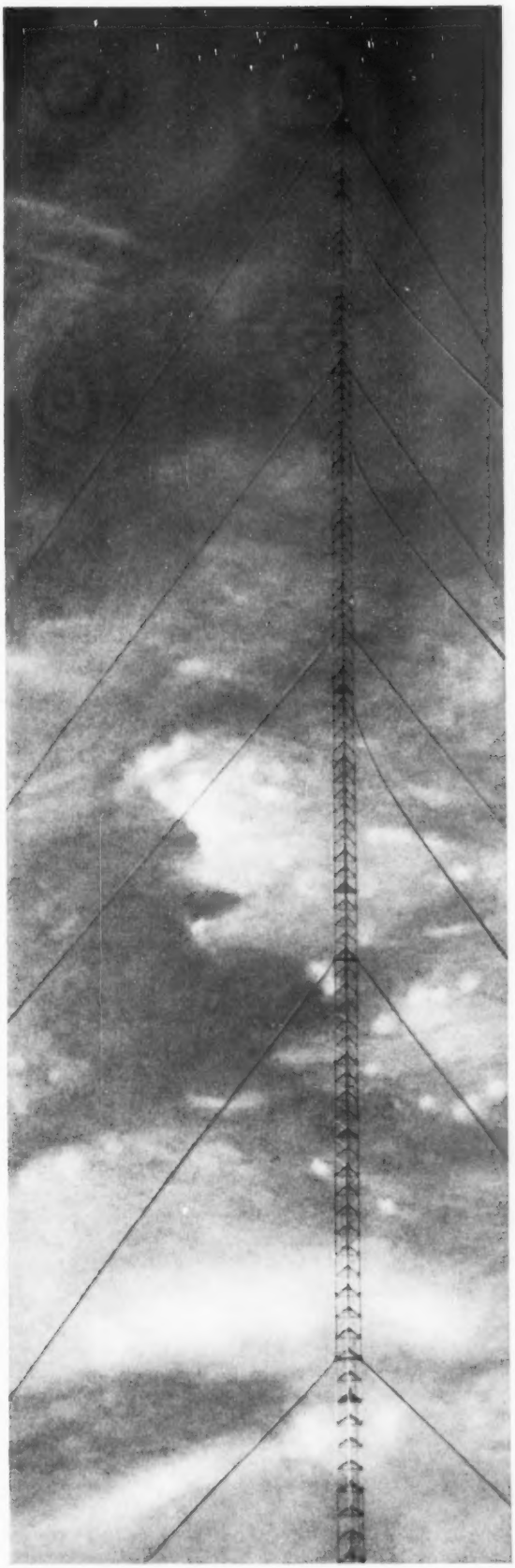
Charlotte Engineers, Inc.
Charlotte, North Carolina.
Extension and addition to facilities at Douglas Aircraft Co. missile plant, Charlotte, N.C. (civil, struc., mech., elec.) $1 million. Client, Corps of Engineers, Wilmington, North Carolina

W. M. Wallace, II
Durham, North Carolina.
New science building, Meridith College, Raleigh, N.C. Plumbing, heating, ventilating, electrical. (mech., elec.) $450,000. Client, Harris & Pyne, Architects, Durham, North Carolina.

Kegarise Engineering Company
Winston-Salem, North Carolina.



Manufacturing building and ware-



Six Sets of Roebling Guys Keep 1356 Foot TV Tower in (and on) the air

The WTEN-TV transmitting tower in Albany, N. Y. is the second tallest man-made structure east of the Mississippi River, taking second place only to the Empire State Building. Kline Iron & Steel Co. of Columbia, South Carolina, designed, fabricated and erected this "Kimco Tower." Two even taller towers are contemplated at Durham, N. C. and Columbia, S. C. When completed these will be the tallest towers in the East.

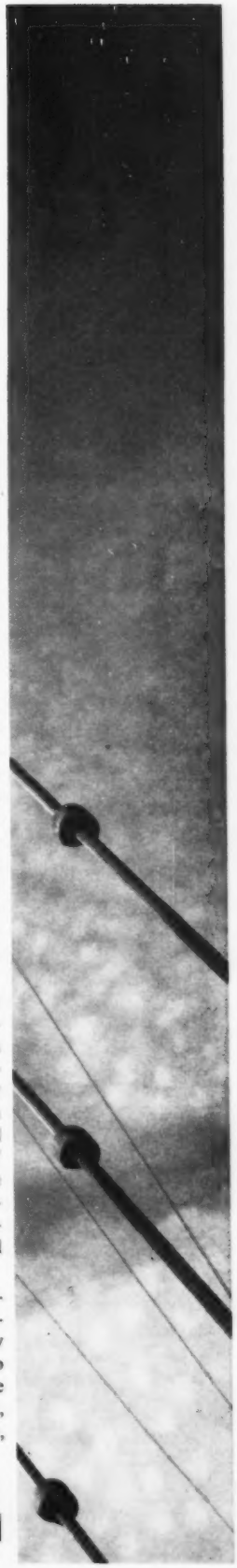
This Kimco Tower is held vertical to the earth by approximately 19,305 feet of various sizes of Roebling prestretched galvanized bridge strand. Specifically, the tower is guyed in this manner, starting from the ground up: three 630-ft. strands of 1″ diameter; three 730-ft. strands of 1″ diameter; three 870-ft. strands of 1⅛″ diameter; three 1,230-ft. strands of 1⅛″ diameter; three 1,400-ft. strands of 1¼″ diameter; and topmost guys 1,575 ft. long with a diameter of 1⅛″.

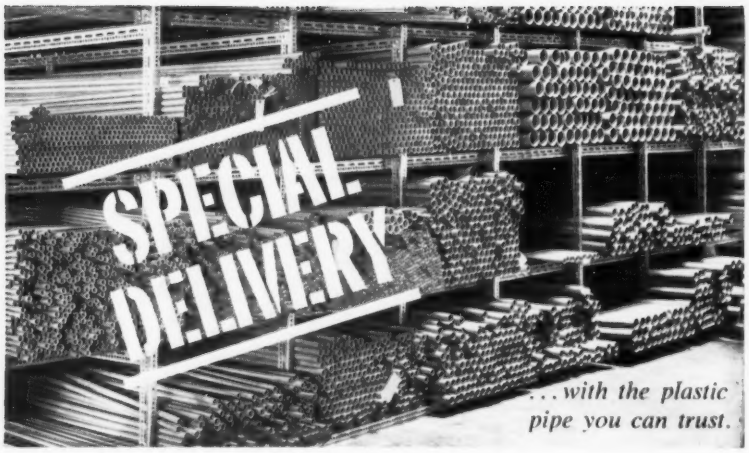
Literally, this is a new height in Roebling's experience. It requires manufacturing facilities that can furnish long lengths of strand to close tolerances (actually, each guy is accurately measured, under controlled tension, in feet and inches). Plus an unrivaled experience with suspension systems of all kinds. Roebling's activities in the suspension field include: bridges, tramways, ski lifts, materials-handling, suspended roofs and, of course, guyed towers.

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C. M. Maratta & Associates
Canton, Ohio.
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Canton Public Library annex. (struc., mech., elec.) $150,000. Client, Canton Public Library Association, Canton, Ohio.

New factory and office. (civil, struc., mech., elec.) $200,000. Client, Convoy Incorporated, Canton, Ohio.

Clauer Associates
Wooster, Ohio.
Elks Club addition, Wooster, Ohio. One-story, brick and steel building. $30,000. Client, The Elks Home Co.

John W. Salm & Associates
Coldwater, Ohio.
Installation of 4 kv and 13.8 kv switchgear and associated substations. (elec.) $650,000. Client, City of Piqua, Ohio.

RHODE ISLAND

Fred S. Dubin Associates
Hartford, Connecticut.
Naval base, B.O.Q., Newport, R.I. (mech., elec.) $1,250,000. Client, Cull, Robinson & Green, Arch.

Peter A. Mikal, Consulting Engineer
Providence, Rhode Island.
Municipal building (police, fire, and town hall), West Warwick, R.I. (mech.) $600,000 (total). Client, Town of West Warwick, R.I., Almanzor J. Samson, Arch., West Warwick, R.I.

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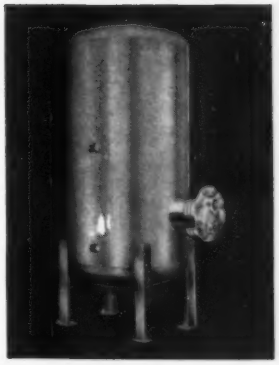
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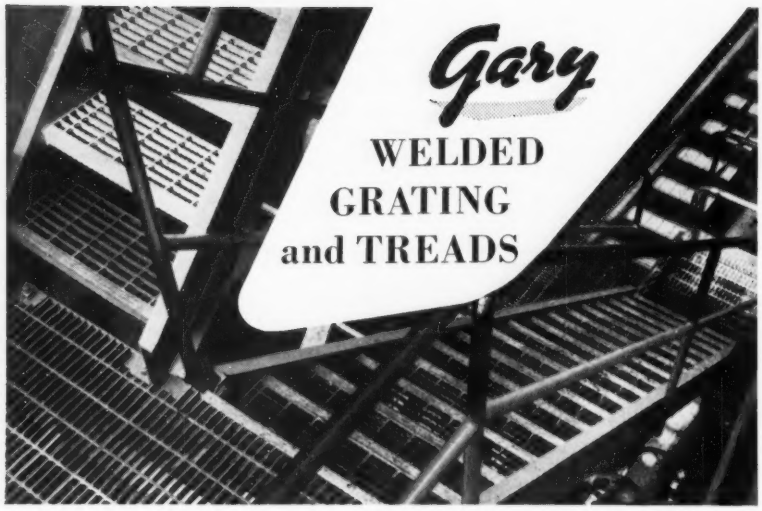
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conditioning component parts at altitudes up to 100,000 feet with temperature range from minus 100 F to plus 1200 F. (civil, struc., mech., elec.) $2,225,000. Client, Arnold Research & Development Center, Corps of Engineers, Tullahoma, Tenn.

Stanley G. Simm, Consulting Engineer
Nashville, Tennessee.
Sumner County Hospital, Gallatin, Tenn. (elec.) $900,000 (total). Client, Taylor & Crabtree, Arch., Nashville, Tenn.

Nashville Municipal Airport, Nashville, Tenn. (elec.) $3 million (total). Client, Donald F. Steinbaugh and Assoc., Arch., Nashville, Tenn.

Wharton School, Nashville, Tenn. (elec.) $650,000 (total). Client, James M. Wilson, Arch., Nashville, Tennessee.

VERMONT

Fred S. Dubin Associates
Hartford, Connecticut.
Library, Bennington College, Vermont. (mech., elec.) $500,000. Client, Carl Koch Assoc. & Pietro Belluschi, Arch.

VIRGINIA

Silver Associates
Nansemond County, courthouse additions and renovation, Suffolk, Va. Heating, air conditioning, ventilating, plumbing, and electrical. (mech., elec.) $80,000. Client, Shriver & Holland, Arch.

Hardesty & Hanover
New York, New York
Design of movable bridge and approach spans over south branch of Elizabeth River at Norfolk, Va. (struc.) $1,400,000. Client, Department of Highways, Commonwealth of Virginia.

Design of vertical lift bridge and approach spans over James River at Jordan's Point near Hopewell, Va. (struc.) $5,600,000. Client, Department of Highways, Commonwealth of Virginia.

WEST VIRGINIA

Charles W. Stewart,
Structural Engineer
Huntington, West Virginia
Storage warehouse, Washington, W. Va. $350,000. Client, Parkersburg Industrial Warehouse Corp., Parkersburg, W. Va.

First National Bank of Ceredo, Ceredo, W. Va. (struc.) $180,000. Client, H. J. Stark, Pres. ▲▲

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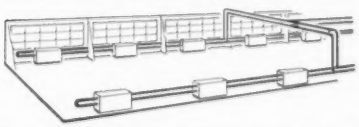
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The system includes a Nesbitt Syncretizer unit ventilator in every classroom, with Wind-o-line finned radiation installed along the sill.

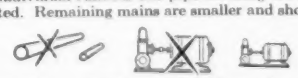


The Wind-o-line copper tubing takes the place of the usual supply and return mains. Two-pipe direct or reversed return circuits are used, with a group of classrooms or even an entire wing of the building in a single circuit. Each classroom is individually controlled.

The Syncretizer multipass heating element extracts the required heat from a smaller quantity of water. System water temperature is automatically varied with outside temperature.



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Since only one-half to one-third the usual amount of hot water is circulated, smaller, less costly pipes and pumps are used.

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Books

For the Libraries of Consulting Engineers

AN INTRODUCTION TO SEMICONDUCTORS, by W. Crawford Dunlap, Jr.; John Wiley & Sons, Inc.; 417 pp.; $11.75.

Reviewed
by
Loren E. Bollinger
The Ohio State University

In writing this book the author had in mind primarily engineers, technicians, and research workers who are beginning work with semiconductors and secondarily students approaching or actually enrolled in graduate school. It is obvious that Dunlap presupposes that the reader has had an adequate mathematical background since considerable calculus and a few tensors appear. No attempt is made to give detailed mathematical derivations. Instead the final results are given, generally with adequate reference to the original source or to the supplementary sources of information. Medium-level courses in physics or in engineering in which crystals, crystal structure, cathode theory, and statistical mechanics have been covered would be of definite benefit to the reader of this book.

Dr. Dunlap served as a consultant on semiconductors with the Electronics Laboratory of the General Electric Company. He has directed activity in all phases of the subject matter upon which he has written. His patents and papers relate to research studies on transistors, infrared detectors, photocells, Hall effect devices, germanium processing, and methods of producing p-n junctions. Recently Dr. Dunlap joined the Bendix Aviation Corp. as supervisor of Solid State Research in their Research Laboratories.

In the fore part of the book the author considers the various properties and the structure of perfect crystals. After introducing the theory of the solid state, he discusses the effect of imperfections in crystals and the statistical-mechanics approach to metals and semiconductors. A very good presentation is made by Dunlap of the electron theory of metals and semiconductors together with the contact and surface properties of semiconductors.

Many details are given regarding the properties of p-n junctions and the experimental measurements on semiconductors. Some of the processes used to prepare semiconductor materials are discussed. Properties of elemental semiconductors such as germanium, silicon, germanium-silicon alloys, selenium, tellurium, gray tin, etc., are presented. Next the semiconducting compounds, gallium antimonide, silicon carbide, lead sulfide, zinc oxide, cuprous oxide, etc., are discussed.

Two major practical applications of semiconductors, rectifiers, and transistors, are considered in separate chapters, while the final chapter presents material on photocells, thermistors, Hall effect, and other applications of semiconductors.

Consulting engineers working with semiconductor devices will find this book an invaluable reference book since it is the first single volume to offer a rather complete coverage of the topic. The approach of the book is generally physical as opposed to a formal presentation of theory. However, technicians probably would not have sufficient preparatory background for many sections. Also, graduate students will find the book suitable as a source of supplemental material but not as a classroom text.

The author is to be complimented for consolidating the diversely located information on semiconductors into a single, integrated volume.

•

PRINCIPLES OF THE PROPERTIES OF MATERIALS, by Jacob Porter Frankel; McGraw-Hill Book Co., Inc.; 240 pp.; $6.00.

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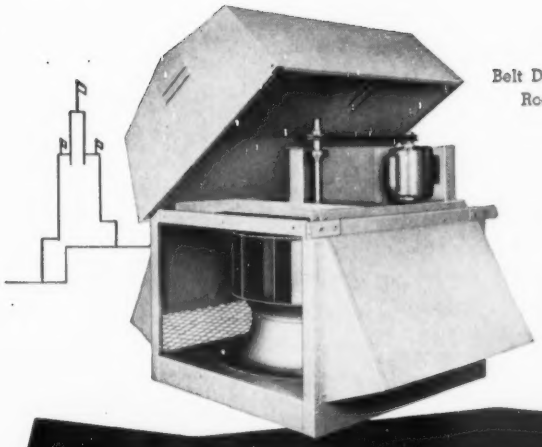
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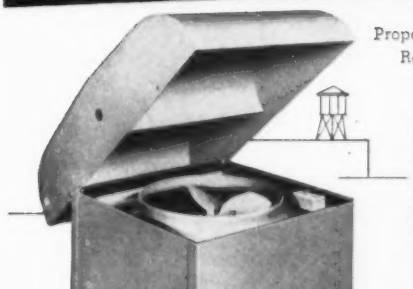
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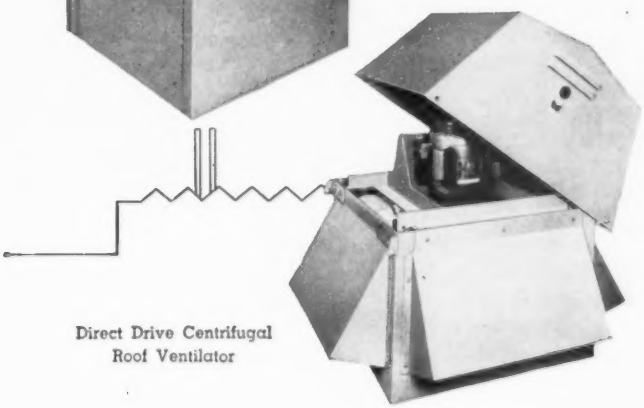
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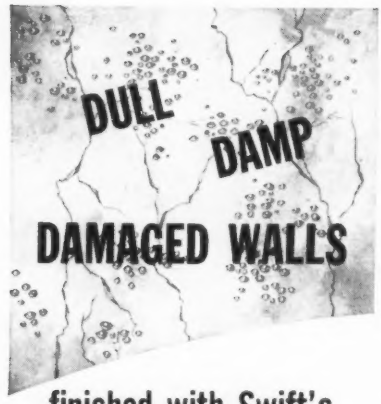
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•

ESTIMATING GENERAL CONSTRUCTION COSTS, 2nd Ed., by Louis Dallavia; F. W. Dodge Corp.; 197 pp.; $8.50.

Fully revised and simplified, this second edition replaces the 1954 volume. It presents a method developed by the author for estimating all direct production cost in earthwork, reinforced concrete work, structural steel work, masonry, and carpentry. The system takes into account such variables as job conditions, weather, the general economy, and equipment quality, with tables giving corrections for differing job conditions and cost levels.

•

NUCLEAR CHEMICAL ENGINEERING, by Mason Benedict and Thomas H. Pigford; McGraw-Hill Book Co., Inc.; 594 pp.; $9.50.

Written by a professor and associate professor of nuclear engineering at Massachusetts Institute of Technology, this book describes the materials important in nuclear reactors and the novel processes developed to concentrate, purify, and separate these materials, giving an account of both scientific and engineering principles involved. Material presented at the International Conference on Peaceful Uses of Atomic Energy held in Geneva in 1955 is included, as well as hitherto unpublished methods for designing isotope separation plants and for estimating the change in composition and reactivity of nuclear fuels during irradiation.

Since it combines scientific and engineering principles with a description of significant materials and processes, the text serves as a valuable source book on chemical engineering practice in nuclear technology.

•

ANALOG-DIGITAL CONVERSION TECHNIQUES, edited by Alfred K. Susskind; The Technology Press of MIT; 417 pp.; $10.00.

Developed from an informal set of notes prepared in 1956 for the first MIT Special Summer Program on Analog-Digital Conversion Techniques, this year's edition, completely rewritten and expanded for the 1957 Summer Program, has been designed for the practicing engineer to provide the necessary background for those who do not have previous experience in the field. It includes: an introduction to the theory of sampling, quantizing, and coding; detailed analysis and evaluation of basic coding and decoding methods for electrical and mechanical analog quantities; and a case study showing how basic principles were applied in a typical digital flight-test instrumentation system.

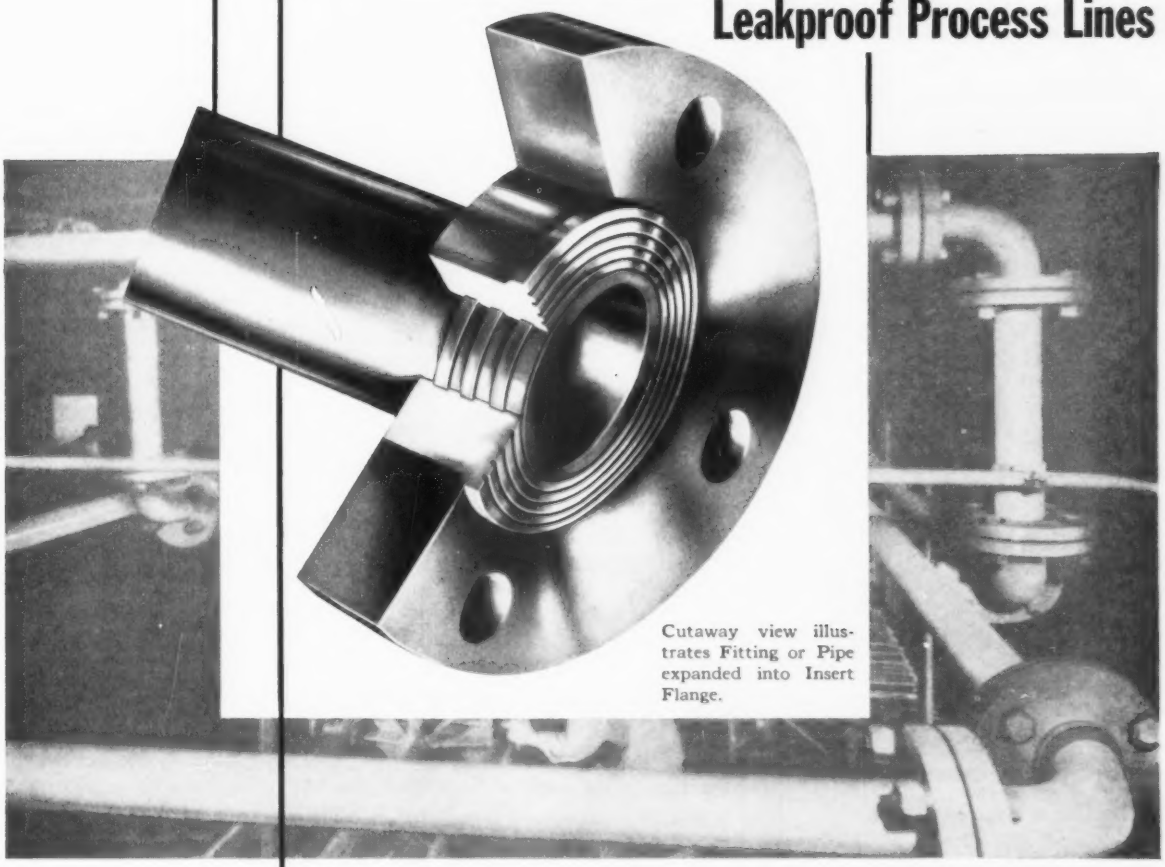
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CONTROL ENGINEERING MANUAL, edited by Byron K. Ledgerwood and the staff of Control Engineering; McGraw-Hill Book Co., Inc.; 200 pp.; $7.50.

This book points out what must be known about a process before it is possible to design a system to control it. After discussing a variety of typical processes, it analyzes tentative control system configurations by means of mathematical, trial and error, computer, and graphical techniques. Tests for the evaluation of a designed system also are included in the text, and many practical examples with illustrations are furnished.

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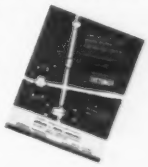
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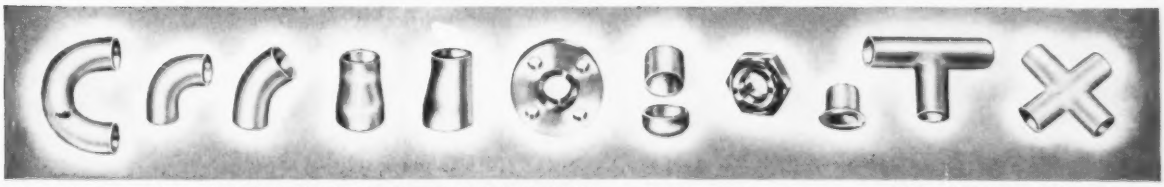
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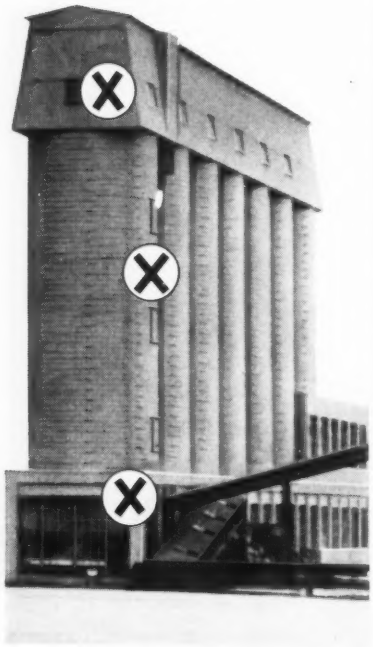
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•

HANDBOOK OF NOISE CONTROL, edited by Cyril M. Harris; McGraw-Hill Book Co., Inc.; 1184 pp.; $16.50.

Edited by an associate professor of electrical engineering at Columbia University, this volume contains papers by 46 experts in the field covering the nature of noise, its measurement, and techniques of its control in buildings, industry, transportation, and the community. Treatment of special types of noise sources and their control includes such trouble spots as gears, bearings, fans, air distribution systems, water systems, transformers, motors, and refrigeration systems.

•

MANUAL OF PRACTICE FOR DETAILING REINFORCED CONCRETE STRUCTURES; American Concrete Institute; wire spiral bound; $4.00.

ACI has combined its popular "Manual of Standard Practice for Detailing Highway Structures" and the "Manual of Standard Practice for Detailing Reinforced Concrete Structures" into one volume since so many items are common to both the buildings and highway structures manuals.

The two main sections of the new manual have been differentiated for reference purposes as buildings and bridges, grouping under "buildings" all structures which would come under the city building code and under "bridges" all structures which would come under a state highway department.

Tables, text, and drawings have been corrected to embody the revisions of the latest ACI Building Code (ACI 318-56). Incorporated into the book are 58 fold-in drawings offering the reader graphic illustrations of specific details of standard practices. One of the drawings added is an alternative method of delineating a concrete design, substituting elevations of beam runs for the schedule form.

The other major change is the addition of a chapter that considers the designer's viewpoint. This chapter was added because it was found that detailing manuals were proving of considerable value to architects and consulting engineers as to standard practices in reinforcing steel and best methods of conveying design information to detailers.

•

THERMODYNAMICS FOR CHEMICAL ENGINEERS, 2nd Ed., by Harold C. Weber and Herman P. Meissner; John Wiley & Sons, Inc.; 507 pp.; $8.50.

A 50 percent enlargement of the text the first edition has enabled the authors to provide up-to-date information on power cycles, engines, refrigerators, and fluid flow, including a more comprehensive coverage of principles and applications.

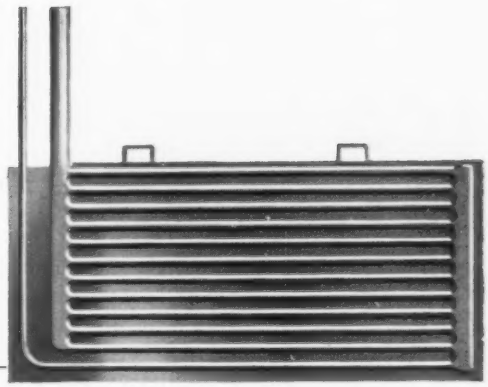
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THERMAL STRESSES, by B. E. Gatewood; McGraw-Hill Book Co., Inc.; 232 pp.; $7.50.

Since emphasis is on fundamental theory, the material in this book is applicable to many types of machines other than aircraft, which is the author's field. It can be applied to nuclear reactors, rocket motors, steam and gas turbine design, and guided missile air frames, making the book of interest to mechanical,

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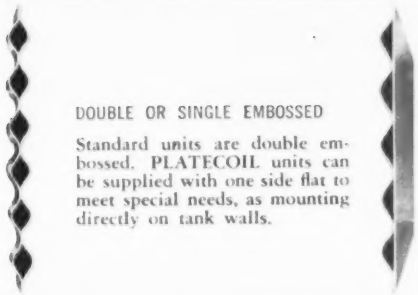


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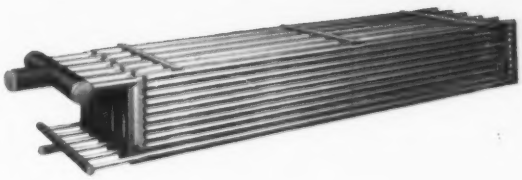
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•

ALUMINUM BUS CONDUCTORS TECHNICAL MANUAL; Kaiser Aluminum & Chemical Sales, Inc.; 176 pp.; $7.50 (available without cost if it is ordered on company letterhead).

Designed as a basic guide for use in engineering aluminum conductor installations, the book illustrates, describes, and classifies the aluminum bus bar shapes and alloys now available and outlines the most advantageous utilization of aluminum for various electrical bus bar designs.

•

The Illinois Society of Professional Engineers has published its third registration examination questions book under the title "Structural Examination Questions Book, 1st Ed." It is divided into four sections: General Engineering; Reinforced Concrete; Steel Structures; and Wood, Masonry & Foundations — based on questions used in previous examinations given by the Illinois Department of Registration and Education. It is available from the Executive Secretary, ISPE, 614 E. Green St., Champaign, Ill. The other two books, available at $1.50 and $1.00, respectively, are "Professional Engineer, 4th Ed.," and "Land Surveyor, 1st Ed."

FILMS

"YOU AND LABOR LAW," Employers Labor Relations Information Committee, Inc., sound and color slidefilm, 30 min.

The first section of the two-part film shows the evolution of labor law philosophy and precepts, tracing the history of labor laws through the World War I Labor Board, the NRA, the Norris-La Guardia Act, the Wagner Act, and the Taft-Hartley labor legislation.

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"3 DIMENSIONAL DRAFTING," John R. Cassell Co., Inc., sound, black and white, 16 mm.

The advantages of the 3-D methods over flat plane or orthographic drawings are illustrated in this film, which compares the modern technique with conventional methods.

•

"HERE'S HOW, WITH CLAY PIPE," Clay Products Association, sound and color, 20 min.

This film describes, by means of actual location sequences, how to construct modern underground waste systems, including surveying, excavating, sheeting and bracing, bedding, laying, jointing, and backfilling.

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"MOVING MOUNTAINS," Clark Equipment Co., sound and color, 27 min., 16 mm.

Man's efforts through the centuries to improve and speed his ability to move goods and material is documented in this film — from the construction of the pyramids to present-day construction. ▲▲



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Date	Sponsor	Event	Location
March 2-6	American Society of Mechanical Engineers	International Gas Turbine Power Div. Conference and Exhibit	Shoreham Hotel Washington, D.C.
March 3-5	American Management Association	Electronics Conference	Statler Hotel New York, N.Y.
March 5-6	Building Research Institute	Conference on Plastics	University of Houston Houston, Texas
March 17-21	The Atomic Industry	Meeting and 1958 Trade Show	International Ampitheatre Chicago, Ill.
March 19-20	American Society of Mechanical Engineers and American Institute of Electrical Engineers	Engineering Management Conference	Hotel Somerset Boston, Mass.
March 23-29	American Congress on Surveying and Mapping American Society of Photogrammetry	1958 Consecutive Meeting and Co-Exhibit	Shoreham Hotel Washington, D.C.
March 27-29	Electrical Maintenance Engineers Association of Southern California	Conference & Exhibition	Shrine Exposition Hall Los Angeles, Calif.
March 31-April 2	American Institute of Electrical Engineers	Southwest District Meeting	Mayo Hotel Tulsa, Okla.
April 14-15	American Society of Mechanical Engineers	Maintenance and Plant Engineering Group Conference	Penn-Sheraton Hotel Pittsburgh, Pa.
April 14-15	American Institute of Electrical Engineers	Conference on Rubber and Plastics	Sheraton Mayflower Hotel Akron, Ohio
April 14-17	American Society of Mechanical Engineers	Design Engineering Conference	International Ampitheatre Chicago, Ill.
April 20-23	American Institute of Chemical Engineers	General Meeting	Sheraton-Mt. Royal Hotel Montreal, Canada
April 21-23	Building Research Institute	Annual Meeting	Shoreham Hotel Washington, D.C.
May 1-8	American Society of Tool Engineers	1958 Tool Show and Annual Meeting	Convention Hall Philadelphia, Pa.
May 7-11	Western Air Conditioning Industries Association	Conference and Exhibit	Shrine Exposition Hall Los Angeles, Calif.
June 12-14	National Society of Professional Engineers	General Meeting	Chase Hotel St. Louis, Mo.
June 23-27	American Society for Testing Materials	Annual Meeting and Exhibit	Hotel Statler Boston, Mass.

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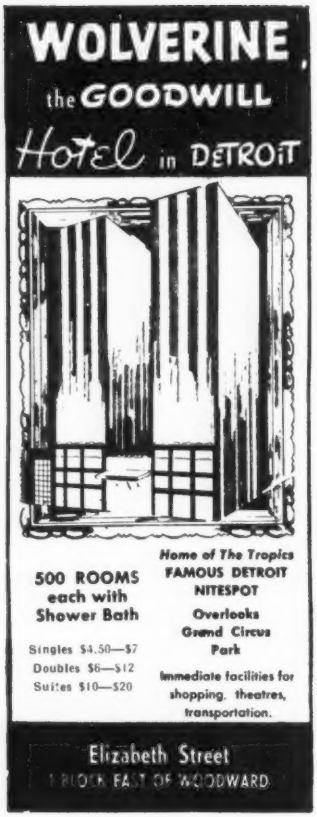
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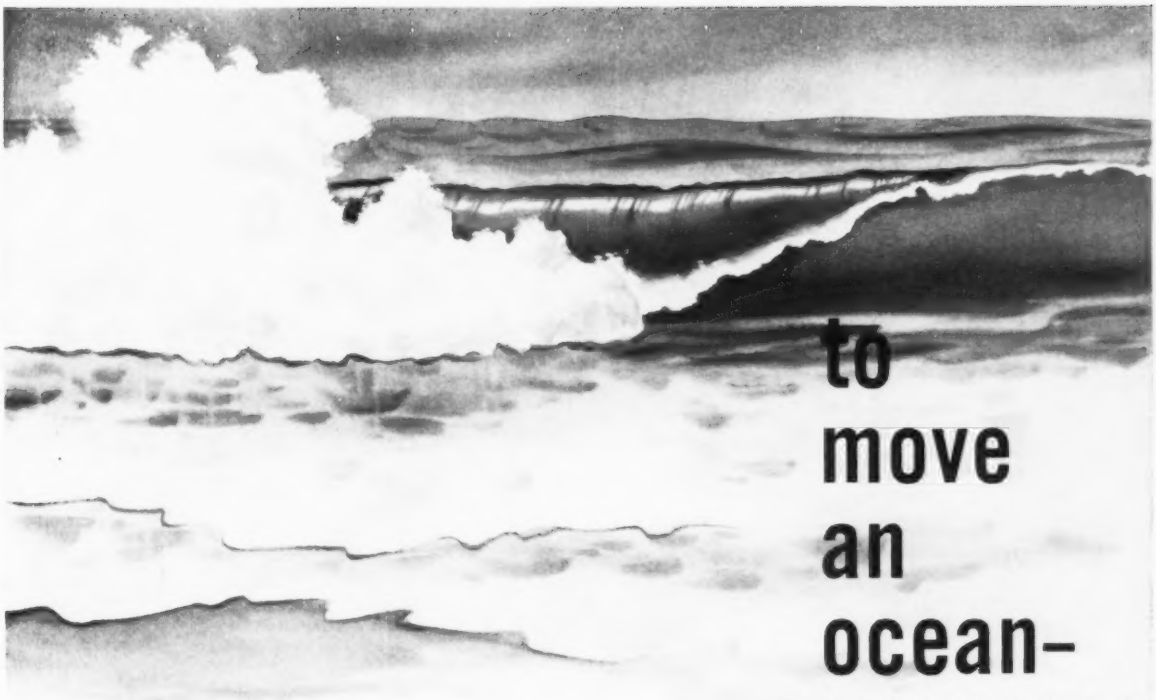
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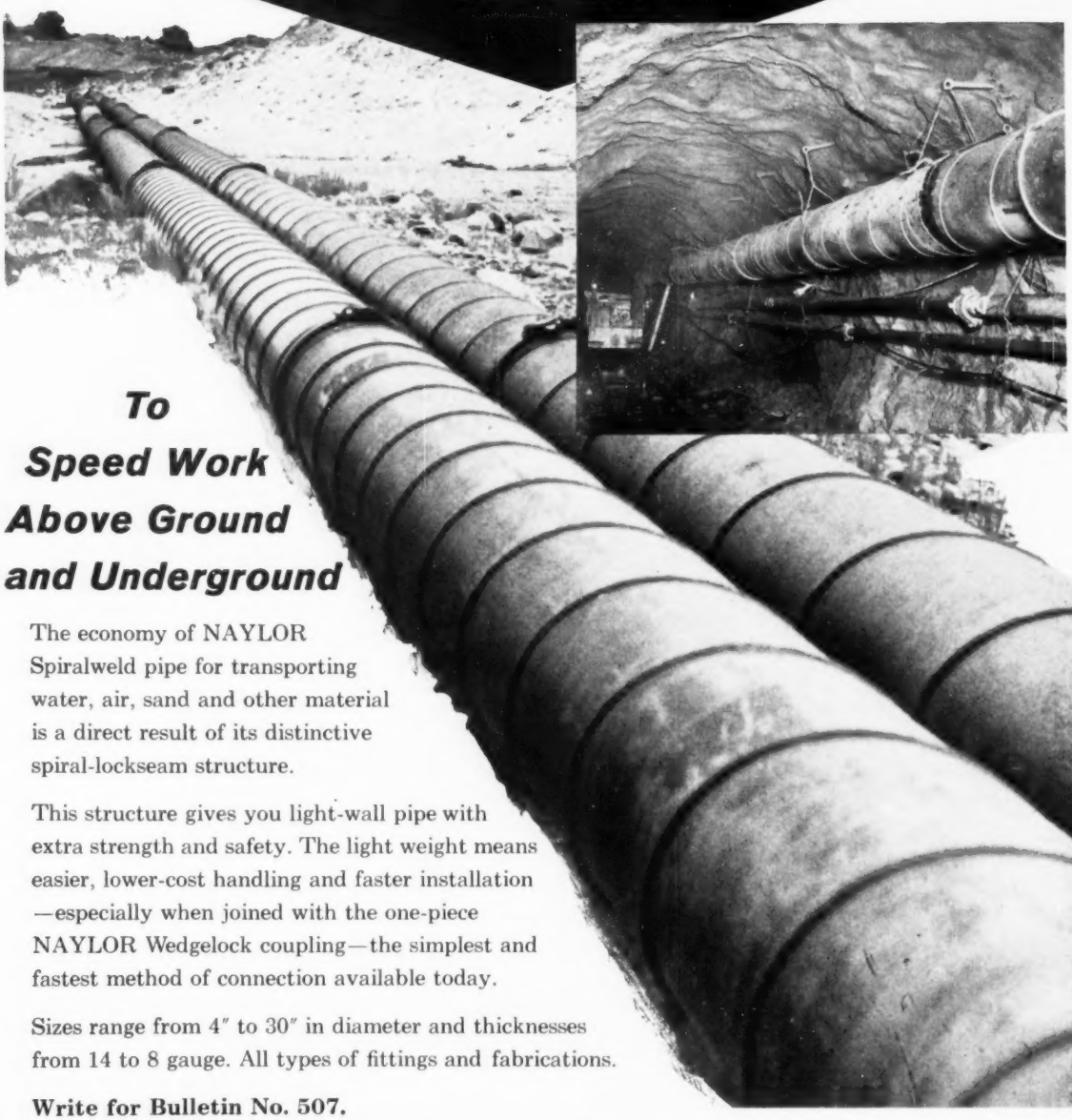
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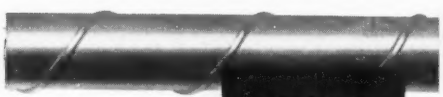
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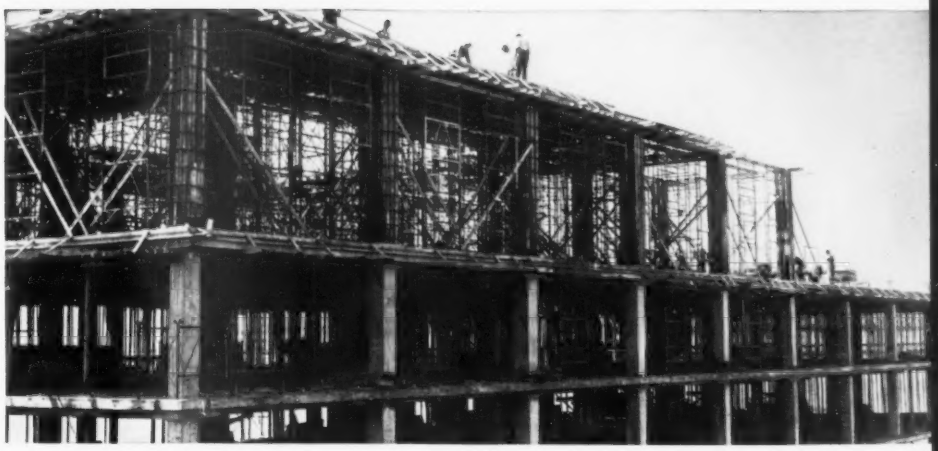
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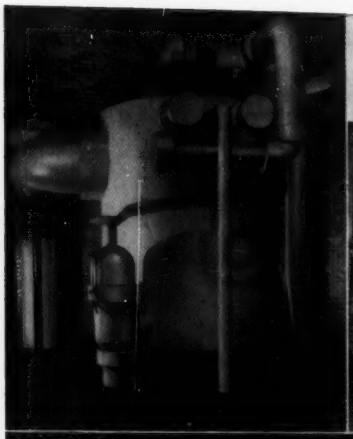
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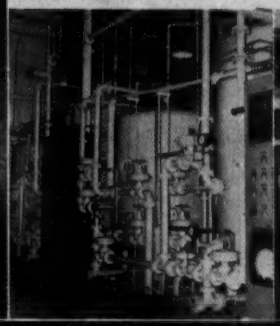


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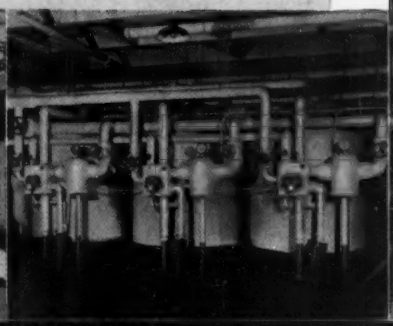
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DEAERATOR



DEMINERALIZER

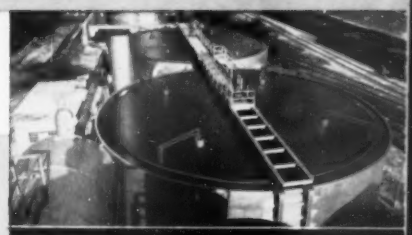


ZEOLITE SOFTENER



HOT PROCESS SOFTENER

Engineering and Equipment by **Cochrane**
assure complete water conditioning service



REACTOR



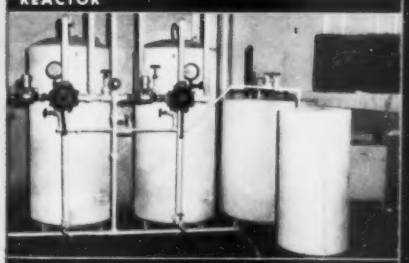
MULTIPORT RELIEF VALVE

For over half a century Cochrane Corporation has pioneered major developments in the field of water conditioning. Today, Cochrane leads in installation of deaeration, hot process and hot lime zeolite equipment.

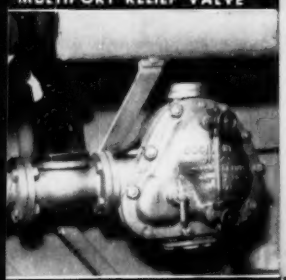
Development of the Cochrane Hydromatic Valve sets a new standard in automatic control for Ion Exchange Processes.

Cochrane's background as heat engineers has also been responsible for the development of steam specialties recognized and used throughout industry today. The C-B Jet Pump improves heat transfer, reduces drying costs with resultant product improvement and usually increases production output.

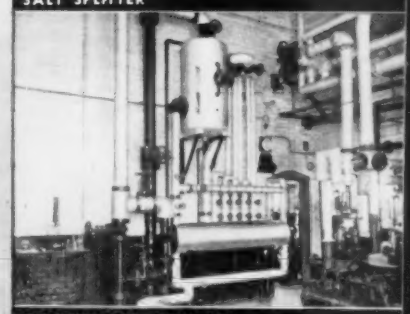
This complete service, available at Cochrane, provides a single responsibility for continuous satisfactory operation of every installation. It is an assurance that guarantees will be met. Why not consult Cochrane?



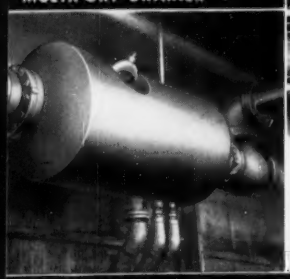
SALT SPLITTER



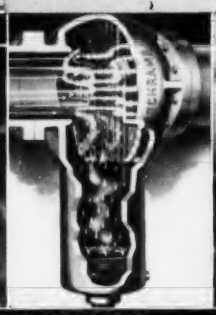
MULTIPORT DRAINER



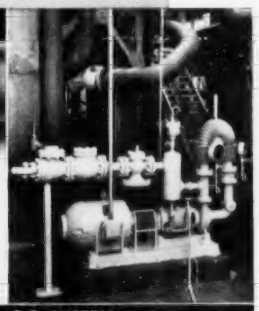
CONTINUOUS BLOW-OFF



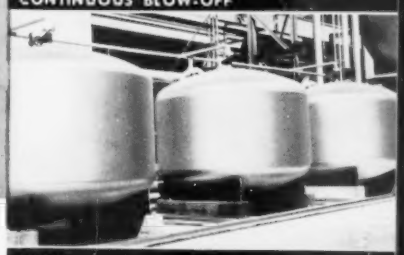
STEAM PURIFIER



OIL SEPARATOR



C-B SYSTEM



FILTER

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